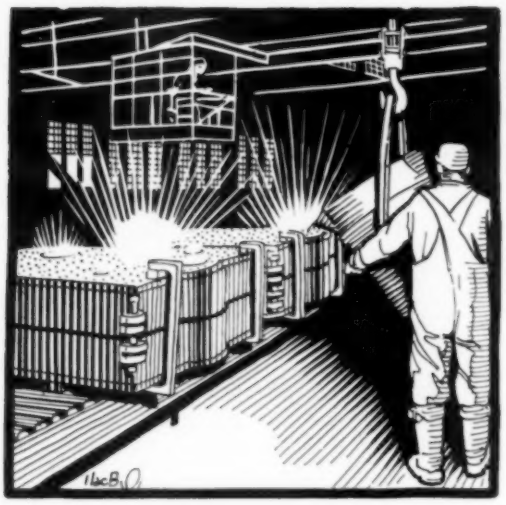


THE FOUNDRY

for August

Confidence Is the Key To Progress

TORONTO'S convention of the American Foundrymen's association offers discussion on problems of management and operation. If those who listen will question, challenge and combat those who offer papers, there should be good for all. Thinking will be stimulated and foundries will make greater progress.

Foundry practice needs stimulating. Tooling and methods of foundries generally have not kept pace with the few leaders, and notably the automotive shops. Perhaps with the same confidence which governs automobile makers, foundries would re-equip their shops.

Foundry management is no less intelligent than that in any other industry. But the intelligence of foundry management must be aroused, sharpened. It must be driven, coaxed, refined, made keen by grinding argument. Brains in the foundry industry are not good enough; neither are they, in other businesses, if they are not brought together, tried and rendered keen, by discussion and difference They are stimulated by meetings such as that in Toronto.

The results will build confidence. It takes confidence to make all business better. It will take confidence to restore the foundry business. Col. Leonard P. Ayres of Cleveland points to the failure "of the combination of great shortages of goods and great accumulations of capital to stimulate business activity." The missing factor is confidence. Capital goes to work in hope of profit. Promises of non-interference by government would not be enough to remove the key log in the jam. Business must *know* reform tinkering is at an end. Then confidence will move the mass of blocked durable goods.

Supplying the shortage of durable goods, plant equipment, will take millions of tons of castings. The time is here for foundries to get ready. They are as ill prepared to meet peak demands as they were to meet the war needs in 1914. Prolonged depression has left them incapable, as a whole, of serving their normal customers.

The opportunity to plan for a better day will be found at Toronto. Every man there will have the same urge—profits. You must have confidence to win them. Confidence in self, in company, in the foundry industry, in American business, resource and spirit.

Management's Job Is Men

FORCED to make bricks without straw, the children of Israel left Egypt. This was the first big walkout. Pharaoh, the boss, did not cure a small grievance and trouble grew because he had no contact with his workmen. He was a poor manager.

Management brings men, equipment and materials together to make products. Manpower is the most important element. Handling men is a job. Today it is complicated by laws, politicians and reformers. Nerves are raw. Personal trials are magnified and little troubles aggravated by those who gain from strife.

If the managers door is open at all times to all employes, opportunity is open to success in the job of handling men. Close contact and understanding is necessary. Understanding was indicated by Robert Kinkead, in *Steel*, who says:

> "The world needs me." "My job is important." Give a man those two affirmative convictions and he becomes socially adjusted and economically productive. . . . Labor upheavals, the cruel insanities of "office politics," failure of an organization to function on account of "buck passing"; these are the end product of a management policy which fails.

Wages and hours are problems partly solved where understanding governs. Questions of organization, representation, rights, battle cries of industrial strife seldom find lodgment in plants where true understanding exists.

Editor

TORONTO PREPARES WELCOME FOR

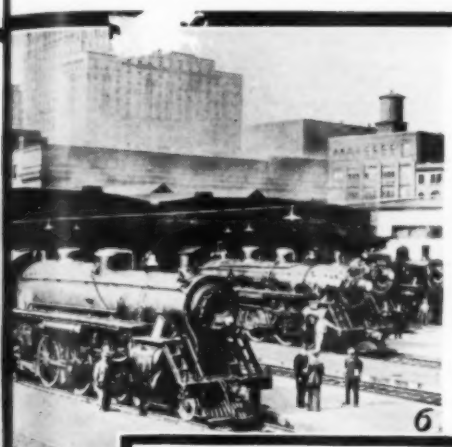
By FRANK G. STEINEBACH

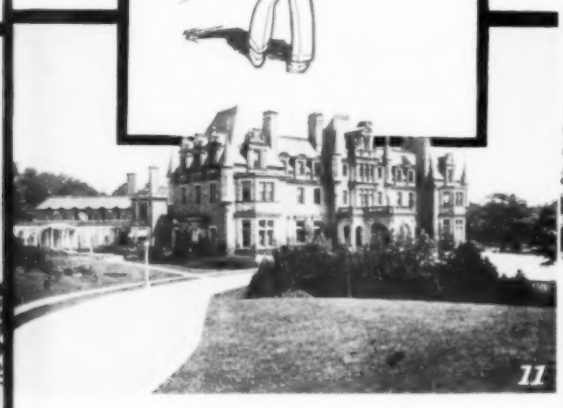
ONCE again the stage is set for the yearly stupendous spectacle of the foundry industry—"Casting Progress in 1935," prepared under the management of the American Foundrymen's association. For the first time since 1908, this annual performance, produced for the benefit of the foundry industry as a whole, will be held in Toronto, Canada, with a committee of local foundrymen handling many details which must precede the opening curtain. The theater is the Royal York hotel where facilities for every convention activity abound.

A few of the men playing leads in the revue of 1908 again will carry important parts in the coming production. Most notable, of course, is Maj. L. L. Anthes, president, Anthes Foundry Ltd., Toronto, who was elected president of the association at the previous Toronto convention in 1908, and this year is to be the recipient of the John A. Penton gold medal, the major award of the American Foundrymen's association for 1935. In addition, Major Anthes heads the committee of Toronto district foundrymen planning the reception and entertainment features.

Advance billings indicate that Technical Director Kennedy and his assistants have a program which undoubtedly will surpass all pre-

AMERICAN FOUNDRYMEN'S ASSOCIATION



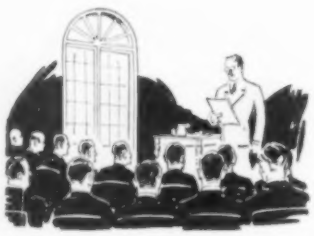


vious convention presentations from the standpoint of variety, value, timeliness and practical application. All of the previous hits will appear in new costumes, and in addition many new numbers have been added. The cast includes many of the leaders of foundry thought in North America, with several parts assigned to European artists. Stage directors for the various parts of the 5-day production have been selected for their ability to interpret lines; to instill enthusiasm into the performance.

Special entertainment features have been arranged for the intermissions in the program. For the ladies, a tea at the Royal Canadian Yacht club is planned for Tuesday afternoon, and a tea at the Granite club has been arranged for Wednesday afternoon. The trip to the yacht club will be made by boat, and to the Granite club by cars. Toronto with its fine stores, and many points of interest will provide further splendid entertainment for the ladies at the convention.

Illustrations on pages 20 and 21 are reproduced through the courtesy of the Toronto Convention and Tourist association, the Toronto Industrial Commission and the Canadian National Exhibition. 1—Casa Loma; 2—Toronto Skyline; 3—Parliament Buildings; 4—Western Harbor Channel; 5—Royal York Hotel; 6—Union Depot Train Tracks; 7—Eastern Harbor Terminals 8—Mary Pickford's Birthplace; 9—Soldiers Memorial Tower, University of Toronto; 10—City Hall; 11—Home of Lieutenant Governor of Ontario; 12—Canadian National Exhibition

The featured intermission specialty is the annual dinner to be held in the ball room of the Royal York hotel on Thursday evening. A speaker nationally prominent in Canada, presentation of the medal and musical numbers assure splendid entertainment for that portion of the convention program. Following the dinner, the Toronto committee will tender a reception and dance to the visiting foundrymen and ladies. Another important feature of the convention program, and one which will be of interest to all types of foundrymen, has been provided by the plant visitation committee. Numerous plants which will be available for inspection by visiting foundrymen on Tuesday and Wednesday afternoons of convention week are listed on page 28 of this issue. The golf committee will arrange facilities for those seeking that form of recreation with information available at the registration desk in the convention lobby of the



TENTATIVE PROGRAM

Monday, Aug. 19

Committee Meetings

Tuesday, Aug. 20

10:00 a.m.—Formal Convening of 39th Annual Convention.

Presiding—President Dan M. Avey.
Address of Welcome—by L. L. Anthes, Chairman, Toronto Foundry Committee.
Response.
President's Address.
Reports of Officers.

11:00 a.m. to 1:00 p.m.—Cast Iron.

Chairman—H. Bornstein, Deere & Co., Moline, Ill.; vice chairman, V. A. Crosby, Climax Molybdenum Co., Detroit.
Impact Resistance and Other Physical Properties of Alloy Cast Iron, by G. P. Phillips, International Harvester Co., Chicago.
Heat Treatment of Cast Iron, by R. G. McElwee, Ecorse Foundry Co., Ecorse, Mich.
Hardening Anneal of Austenitic Iron, by G. R. Delbart, Denain, France.

11:00 a.m. to 1:00 p.m.—Foundry Sand Research.

Chairman—H. B. Hanley, American Laundry Machinery Co., Rochester, N. Y.
Expansion and Contraction of Molding Sand Under Elevated Temperatures, by H. W. Dietert, H. W. Dietert Co., Detroit.
Reports of Committees:
Committee on Tests.
Committee on Durability
Committee on Fineness.

Afternoon—Plant Visitation and Recreation.

7:00 p.m.—Foundry Equipment Manufacturers Dinner and Meeting.

8:00 p.m.—Refractories.

Chairman—A. M. Ondreyco, Mechanite Metal Corp., Pittsburgh, Pa.; vice chairman, J. M. McKinley, North American Refractories Co., Cleveland.
Some Uses of Insulating Refractories in Modern Foundry Practice, by C. L. Norton, Babcock & Wilcox Co., New York.
Malleable Furnace Refractories, by L. C. Hewitt, Laclede Christy Clay Products Co., St. Louis.
Round Table Discussion on Foundry Refractories.

8:00 p.m. to 9:00 p.m.—Sand Shop Course (Session 1).

Chairman—Neil I. MacArthur, Great Lakes Foundry Sand Co., Detroit; discussion leader—George F. Pettinos, George F. Pettinos, Inc., Philadelphia.
New Sand Qualities.

9:00 p.m. to 10:00 p.m.—Cast Iron Shop Course (Session 1).

Chairman—John Grennan, University of Michigan, Ann Arbor, Mich.
Cupola Melting.

Wednesday, Aug. 21

9:00 a.m. to 11:00 a.m.—Malleable Cast Iron.

Chairman—R. J. Teetor, Cadillac Malleable Iron Co., Cadillac, Mich.
Endurance Tests of Malleable Iron, by E. G. Mahin, University of Notre Dame, and J. W. Hamilton, Bendix Products Corp., South Bend, Ind.
Notes on the Production of Cupola Malleable Iron Fittings, by F. B. Riggan, Stockham Pipe & Fittings Co., Birmingham, Ala.
Report of Committee on Specifications.
Report of Committee on Nomenclature.

9:00 a.m. to 11:00 a.m.—Materials Handling and Foundry Equipment.

Chairman—James Thomson, Continental Roll & Steel Foundry Co., East Chicago, Ind.; vice chairman, Pat Dwyer, THE FOUNDRY, Cleveland.
Mechanical Handling of Sand and Castings for Small Tonnage Plants, by E. W. Beach, Campbell, Wyant & Cannon Foundry Co., Muskegon, Mich.
Mechanical Charging for Small Tonnage Foundries, by D. J. Reese, Whiting Corp., Harvey, Ill.

11:00 a.m. to 1:00 p.m.—Cast Iron.

Chairman—James T. MacKenzie, American Cast Iron Pipe Co., Birmingham, Ala.; vice chairman—W. H. Spencer, Sealed Power Corp., Muskegon, Mich.
Structure and Properties of Gray Cast Iron, by A. DiGiulio and A. E. White, University of Michigan, Ann Arbor, Mich.
Progress in the Production of Cast Iron for Locomotive Parts, by A. Revburn, Canadian National Railways, Montreal, Canada.
Piston Rings, by T. R. Twigger, British Piston Ring Co., Holbrook Lane, Coventry, England.

11:00 a.m. to 1:00 p.m.—Open Meeting of Foundry Cost Committee.

Chairman—Sam Tour, Lucius Pitkin, Inc., New York.

Afternoon—Plant Visitation and Recreation.

2:30 p.m.—Meeting Gray Iron Founders' society.

8:00 p.m. to 10:00 p.m.—Industrial Health Hazards and Employer Responsibility.

Chairman—President Dan M. Avey.
Dr. Wm. J. McConnell, Asistant Medical Director and Director, Industrial Health Section, Metropolitan Life Insurance Co., New York.
Donald L. Cummins, Assistant Director, Saranac Laboratories, Saranac Lake, N. Y.

8:00 p.m. to 9:00 p.m.—Cast Iron Shop Course (Session 2).

Chairman—Fred J. Walls, International Nickel Co., New York.
Relation of the Air Charge to Cupola Operation, by H. V. Crawford, General Electric Co., Schenectady, N. Y.
Control of Cupola Operation, by J. Grennan and H. L. Campbell, University of Michigan, Ann Arbor, Mich.

8:00 p.m. to 9:00 p.m.—Sand Shop Course (Session 2).

Chairman—H. W. Dietert, H. W. Dietert Co., Detroit; discussion

Royal York. Many golf courses are available.

An entirely new schedule of technical meetings is being tried this year, thus providing much more time for such features as plant visitation and recreation, and at the same time placing certain important sessions in the evenings to permit greater attendance by foundrymen in the Toronto district. First technical sessions of the day will start at 9 a.m., the second at 11 a.m., and the meetings will close at 1 p.m. On both days, technical meetings will be held in the evening, as will be discussed in more detail later.

Meetings of various A.F.A. technical committees, to be held on Monday, will provide the prologue for the initial performance of the 1935 attraction. A number of committee reports to be completed at the Monday meetings, and dealing with problems pertaining to the many ramifications of castings manufacture, will be presented

FOR TORONTO MEETING

leader, Horace Deane, John Deere Co., Moline, Ill.
Foundry Sand Problems Where Natural Sands Are Used.

Thursday, Aug. 22

9:00 a.m. to 10:00 a.m.—Sand Shop Course (Session 3)

Chairman—R. F. Harrington, Hunt-Spiller Mfg. Corp., Boston
Synthetic Sands.

10:00 a.m. to 11:00 a.m.—Cast Iron Shop Course (Session 3).

Chairman—J. A. Sweeney, Florence Pipe Foundry & Machine Co., Florence, N. J.
Adding Ferroalloys in the Cupola, by E. K. Smith, and H. C. Aufderhaar, Electro Metallurgical Co., Chicago.

9:00 a.m. to 11:00 a.m.—Apprentice Training.

Chairman—John H. Ploehn, French & Hecht, Inc., Davenport, Iowa.
Fifteen Years of Foundry Apprenticeship at the Falk Corp., by Victor Hydar, Falk Corp., Milwaukee.
Some Suggestions for Starting and Carrying Out a Foundry Apprenticeship System, by J. E. Goss, Brown & Sharpe Mfg. Co., Providence, R. I.

9:00 a.m. to 11:00 a.m.—Nonferrous.

Chairman—Jerome Strauss, Vanadium Corp. of America, Bridgeville, Pa.
Third Annual Conference on Deoxidation and Degasification of Nonferrous Metals.
Report of Committee on Analysis of Defects, by H. M. St. John, Detroit Lubricator Co., Detroit.
Annual Business Meeting, Nonferrous Division.

11:00 a.m. to 1:00 p.m.—Steel.

Chairman—E. W. Campion, Bonney Floyd Co., Columbus, O.; vice chairman, P. E. McKinney, Bethlehem Steel Co., Bethlehem, Pa.
Contraction and Solidification of Steel for Castings. III—The Rate of Skin Formation, by C. W. Briggs and R. A. Gezelius, Naval Research Laboratory, Anacostia, D. C.
Influence of Temperature Gradients in the Production of Steel Castings, by George Batty, Drexel Hill, Pa. This is the 1935 Exchange paper presented before the Institute of British Foundrymen.
Report of Committee on Impact Tests.
Report of Committee on Chemical Classification of Steels for Castings.
Report of Committee on Specifications.

11:00 a.m. to 1:00 p.m.—Cast Iron.

Chairman—B. H. Johnson, R. D. Wood Co., Philadelphia.
Centrifugal Casting Symposium:
Production of Centrifugal Gray Iron Castings in Water Cooled Molds, by H. W. Stuart, U. S. Pipe & Foundry Co., Burlington, N. J.
Slush Pump Piston Cores by the Centrifugal Process, by A. E. Falk, D & M Machine Co., Torrance, Calif.
Cast Iron Pipe Centrifugally Cast in Sand, by James T. MacKenzie, American Cast Iron Pipe Co., Birmingham, Ala.
Centrifugal Castings, by J. E. Hurst, Sheepbridge Stokes Centrifugal Casting Co., Chesterfield, England.

1:15 p.m. to 3:45 p.m.—Round Table Luncheon Conferences.

(a) Steel—Chairman, A. W. Gregg, Farrell-Cheek Steel Foundry Co., Sandusky, O.
(b) Malleable Cast Iron—Chairman, P. C. DeBruyne, Moline Malleable Iron Co., St. Charles, Ill.
(c) Nonferrous—Chairman, H. J. Roast, Canadian Bronze Co., Ltd., Montreal, Canada.
(d) Cast Iron—Effects of Nitrogen and Oxygen—Chairman, W. H. Spencer, Sealed Power Corp., Muskegon, Mich.

4:00 p.m.—Annual Business Meeting.

7:00 p.m.—Annual Dinner.

10:00 p.m.—Reception by Toronto Foundrymen.

Friday, Aug. 23

9:00 a.m. to 11:00 a.m.—Steel Founding.

Chairman—John Howe Hall, Taylor Wharton Iron & Steel Co., High Bridge, N. J.
Utilization of X-Rays in the Correction of Foundry Practice and for the Proper Control of Welding of Castings, by C. M. Underwood and E. J. Ash, Naval Gun Factory, Washington.
Fabrication of Cast and Rolled Steel, by J. M. Sampson, General Electric Co., Schenectady, N. Y.

9:00 a.m. to 11:00 a.m.—Cast Iron.

Chairman—Walter Seelbach, Forest City Foundries Co., Cleveland.
Report of International Committee on Tests, by W. H. Spencer, Sealed Power Corp., Muskegon, Mich.
Wear Resistance of White Cast Iron, by O. W. Ellis, J. R. Gordon and G. S. Farnham, Ontario Research Foundation, Toronto, Canada.
Slags and Gases in Cupola Operation, by A. H. Dierker, Ohio State University, Columbus, O.

11:00 a.m. to 1:00 p.m.—Dust Control and Safety Codes.

Chairman—E. W. Beach, Campbell, Wyant & Cannon Foundry Co., Muskegon, Mich.
Dust Collection Equipment, by S. D. Moxley, American Cast Iron Pipe Co., Birmingham, Ala.
Methods of Dust Control, by J. D. Leitch, Provincial Department of Health, Toronto, Canada.

11:00 a.m. to 1:00 p.m.—Nonferrous.

Chairman—James L. Wick Jr., Falcon Bronze Co., Youngstown, O.
Founding of Magnesium Alloys, by Dr. J. A. Gann and M. E. Brooks, Dow Chemical Co., Midland, Mich.
High Strength Nonferrous Casting Alloys, by A. J. Murphy, J. Stone & Co. Ltd., Deptford, London. (Exchange paper submitted on behalf of the Institute of British Foundrymen).

Afternoon—Canadian National Exposition.

for discussion at several technical sessions during the week.

The 39th annual convention of the American Foundrymen's association will be opened officially at 10 a.m. on Tuesday when visiting foundrymen will be welcomed to Toronto by the chairman of the local committee and reports of officers will be made. The first of the technical sessions will follow immediately, one being devoted to physical properties, heat treatment and annealing of cast iron, and the other to recent developments in foundry sand research. The afternoon will be free for plant visits and recreation. The Foundry Equipment Manufacturers' association will hold a dinner meeting for all equipment makers Tuesday evening.

Due to the immense popularity of the shop operation courses, as judged by the exceptionally large attendance year after year, these practical discussions, covering a wide variety of foundry problems, should prove exceptionally interesting and valuable at the coming meeting. Discussion leaders are recognized authorities on the particular problems listed for treatment, and undoubtedly will develop their subjects to the greatest benefit and understanding of those attending. The first shop course, from 8 to 9 p.m. on Tuesday, will deal with new sand qualities, while the second, from 9 to 10 p.m. will consider cupola melting. Both subjects present numerous controversial points and should lead to lively discussions. A regular technical session, starting at 8 p.m. Tuesday, will be devoted to foundry refractories, with papers discussing insulating refractories and malleable furnace refractories in general.

Simultaneous sessions from 9 to 11 a.m. on Wednesday will feature two subjects, namely malleable cast iron and materials handling and foundry equipment. Papers on endurance tests of malleable iron, cupola malleable and reports of committees on specifications and on nomenclature, are included in the program for the malleable session. Mechanical handling of sand and castings in small tonnage plants, and mechanical charging of cupolas in small tonnage foundries, will be discussed at the materials handling and equipment meeting.

A session on cast iron, from 11 a.m. to 1 p.m. will consider papers on structure and properties of gray cast iron, production of locomotive parts, and the casting of piston rings. During the same period, the A.F.A. foundry cost committee will hold an open meeting. As previously mentioned, the entire afternoon has been left open for plant visitation and recreation. The Gray Iron Founder's society has scheduled a meeting for Wednesday at 2:30 p.m.

The first session Wednesday evening will consider industrial health hazards and employer responsibility, a most important problem for all connected with the management of foundries. Two recognized authorities on certain phases of the subject will speak. Shop courses Wednesday evening will be devoted to the operation of the cupola and to the use of natural molding sand.

Shop courses will be shifted to the first and second periods in the morning on Thursday, with synthetic sands being the subject under consideration from 9 to 10 a.m. and the use of ferroalloys in the cupola featuring the discussion from 10 to 11 a.m.

With a shortage of skilled men now facing the foundry industry, the meeting on apprenticeship training should attract an unusually large attendance this year. Two speakers, each having considerable experience in the problems pertaining to the training of foundry apprentices, will speak. One will discuss the success of the apprenticeship training program at the Falk Corp. in Milwaukee, and the other will offer some suggestions for starting and carrying out a foundry apprenticeship program.

Another session from 9 to 11 a.m. will deal with nonferrous foundry problems, and will include a report on the third conference on deoxidation and degasification of nonferrous metals, a report of the committee on analysis of defects, and the annual business meeting of the nonfer-

Program Schedule For Convention Week

Monday, Aug. 19

Committee Meetings

Tuesday, Aug. 20

10:00 a.m.—Formal Convening
11::00 a.m.—Cast Iron
11:00 a.m.—Sand Research
Afternoon.—Plant Visitation
7:00 p.m.—F.E.M.A. Dinner
8:00 p.m.—Refractories
8:00 p.m.—Sand Course
9:00 p.m.—Iron Course

Wednesday, Aug. 21

9:00 a.m.—Malleable Iron
9:00 a.m.—Materials Handling
11:00 a.m.—Cast Iron
11:00 a.m.—Open Meeting Cost Committee
2:30 p.m. — Gray Iron Founders' Society
8:00 p.m.—Industrial Health Hazards
8:00 p.m.—Iron Course
8:00 p.m.—Sand Course

Thursday, Aug. 22

9:00 a.m.—Sand Course
9:00 a.m. — Apprentice Training
9:00 a.m.—Nonferrous
10:00 a.m.—Iron Course
11:00 a.m.—Steel
11:00 a.m.—Cast Iron
1:15 p.m.—Round Table Luncheon Conferences
4:00 p.m.—Business Meeting
7:00 p.m.—Annual Dinner
10:00 p.m.—Reception

Friday, Aug. 23

9:00 a.m.—Steel Founding
9:00 a.m.—Cast Iron
11:00 a.m.—Safety Codes
11:00 a.m.—Nonferrous
Afternoon. — Canadian National Exposition

rous group, American Foundrymen's association.

A session on steel founding, from 11 a.m. to 1 p.m. will include papers on contraction and solidification of steel castings, the influence of temperature, and reports of committees on impact tests, chemical specifications and on specifications. A symposium on centrifugal castings will be presented simultaneously with the steel session, and will feature papers on castings produced in water cooled molds, casting slush pump piston cores centrifugally, casting iron pipe centrifugally, and the general subject of centrifugal castings. The latter paper will discuss European practice.

Four round table meetings, for considering steel, malleable, nonferrous and cast iron foundry problems, will open with luncheons at 1:15 p.m. and probably will extend through the greater part of the afternoon. The annual business meeting of the association will convene at 4 p.m. following the roundtable discussions.

The first two sessions on Friday morning will specialize in steel and cast iron. The steel session will discuss papers on the application of the x-ray in the steel foundry, the control of welding, and the fabrication of steel castings and fabricated structures. Papers at the cast iron session will consider the report of the international committee on tests, and papers on wear resistance of white cast iron, and slags and gases in cupola operation.

Consider Plant Housekeeping

A session on dust control and safety codes, which will supplement the Wednesday evening meeting on industrial health hazards and employer responsibility, will open at 11 a.m. and will hear papers on dust collecting equipment

Toronto Committee for A. F. A. Convention

General Committee

Maj. L. L. Anthes, Chairman
Anthes Foundry Ltd.
George C. Crawford, Vice Chairman
Dominion Radiator & Boiler Co. Ltd.
A. G. Storie, Vice Chairman
Fittings Ltd., Oshawa.
O. W. Ellis
Ontario Research Foundation
Joseph Sully
Sully Brass Foundry Ltd.
C. G. Sherwin
Grinnell Co. of Canada, Ltd.
B. G. Newton
MacLean Publications Co.
G. F. Allan
Hoyt Metal Co. of Canada
H. E. Hall
James Morrison Brass Mfg. Co. Ltd.
Fred Armstrong
Port Hope Sanitary Mfg. Co. Ltd.
William T. Muir
Canadian Foundry Supplies & Equipment, Ltd.
R. B. Morley
Industrial Accident Prevention Associations
C. C. MacDonald
Frederic B. Stevens of Canada Ltd.
C. H. O. Pook
Canadian Westinghouse Co. Ltd. Hamilton
Stewart Clare
Clare Bros. & Co., Ltd. Preston
Frank A. Sherman
Dominion Foundries & Steel Ltd., Hamilton
A. R. Goldie
Babcock & Wilcox & Goldie-McCulloch, Ltd., Galt.
S. C. Evans
Taylor-Forbes Ltd., Guelph
R. J. Hopper
Pratt & Letchworth Co. Ltd., Brantford
James B. Bertram
John Bertram & Sons, Ltd., Dundas
Wm. G. Beatty
Beatty Bros. Ltd., Fergus
Hugh Lamont
General Steelwares Ltd., London
John Stevens Jr.
Empire Brass Mfg. Co. Ltd., London
F. Smith
E. Long, Ltd., Orillia
W. H. Clatsworthy
McKinnon Industries, Ltd., St. Catharines
George B. Frost
Smiths Falls Malleable Castings Ltd., Smiths Falls
H. W. Burgess
Wallaceburg Brass & Iron Mfg. Co,. Ltd. Wallaceburg
Oswald Lawson
Windsor-Walkerville Technical High School
H. C. McLean
Western Foundry Ltd., Wingham
W. B. Campbell
Mueller Ltd., Sarnia
H. A. McEwen
Rahn Metals Ltd., North Bay
F. M. Morton
International Harvester Co. Ltd., Hamilton
Ellis H. Jones
Yale & Towne Mfg. Co. Ltd., St. Catharines

Publicity Committee

C. E. MacDonald, Chairman
International Nickel Co. Ltd.
H. V. Butterfield, Vice Chairman
Canadian Machinery & Mfg. News
Francis H. Bell, Vice Chairman
Canada's Foundry Journal

Transportation Committee

Col. C. J. Ingles, Chairman
Toronto Hardware Mfg. Co. Ltd.
Lt. Col. Mess, Vice Chairman
Whiting Corp.
William Coulter, Vice Chairman
Coulter Copper & Brass Ltd.

Hotel and Entertainment

D. B. McCoy, Chairman
Steel Co. of Canada, Ltd.
R. G. Yates, Vice Chairman
Canadian Furnace Co. Ltd.
Port Colborne
Rex Nicholson, Vice Chairman
Algoma Steel Corp. Ltd.
Mrs. George C. Crawford
Mrs. Richard G. Yates
Mrs. Rex Nicholson
Mrs. Melville P. White
Mrs. M. L. Doelman
Mrs. D. B. McCoy
Mrs. J. C. Armer

Golf Committee

J. C. Armer, Chairman
Dominion Forging & Stamping Co., Ltd.
M. L. Doelman, Vice Chairman
Gurney Foundry Co., Ltd.
E. C. Burton, Vice Chairman
Link-Belt Co., Ltd.
Clifford Sherman
Grinell Co., Ltd.
E. Holt Gurney
Gurney Foundry Co., Ltd.

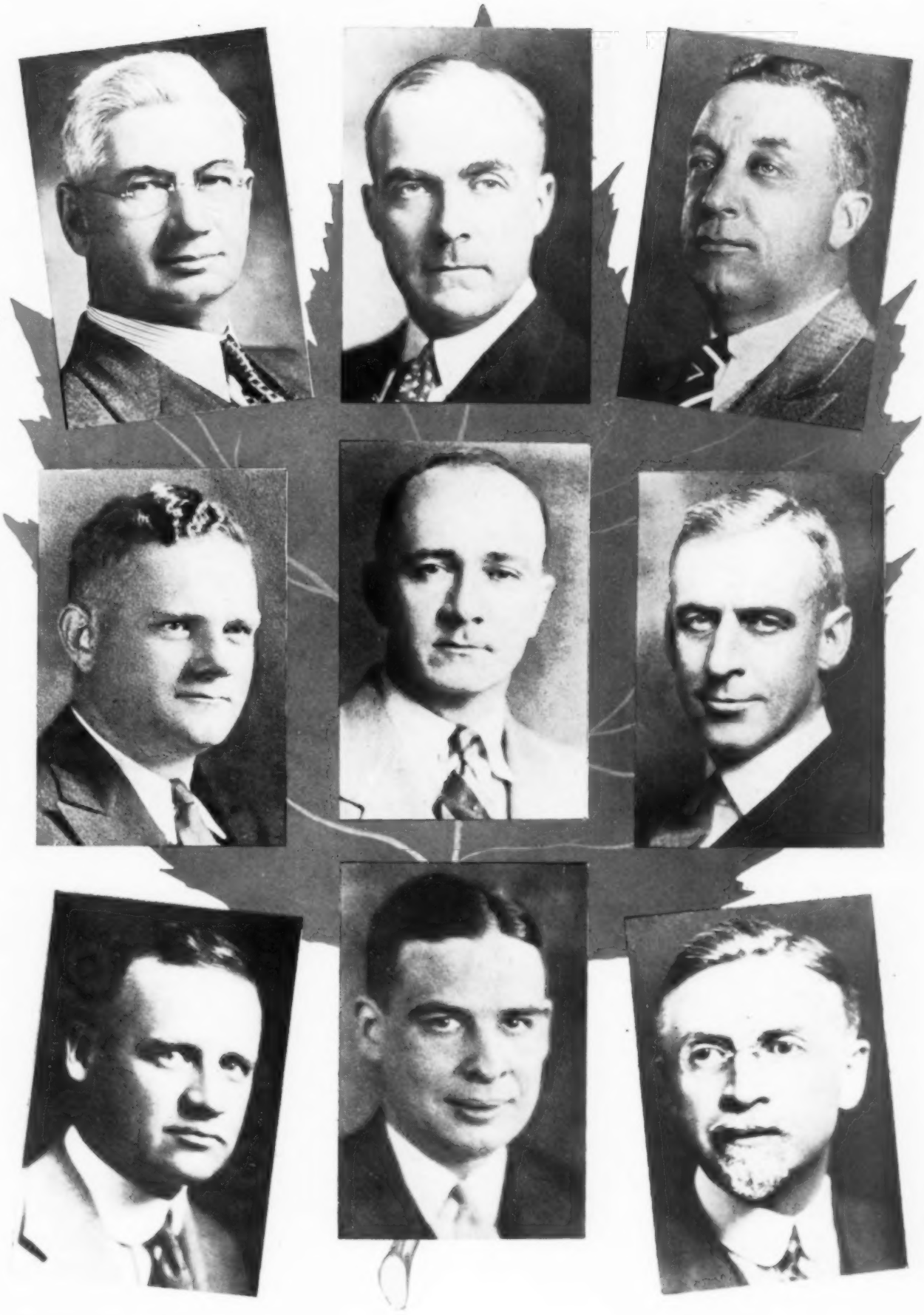
Plant Visitation Committee

Melville P. White, Chairman
Canadian General Electric Co., Ltd.
O. H. Shenstone, Vice Chairman
Massey-Harris Co. Ltd.
C. L. Ley, Vice Chairman
Dominion Wheel & Foundries Ltd.
M. S. Moss
Anaconda American Brass Ltd.
Joseph Sully
Sully Brass Foundry Ltd.
F. M. Morton
International Harvester Co., Ltd., Hamilton
John T. Hepburn
John T. Hepburn, Ltd.
A. G. Storie
Fittings, Ltd., Oshawa
C. H. O. Pook
Canadian Westinghouse Co. Ltd., Hamilton
O. W. Ellis
Ontario Research Foundation

Convener of Committees

John T. Hepburn
John T. Hepburn Ltd.

Top row, left to right—Maj. L. L. Anthes; H. V. Butterfield; Frank A. Sherman. Middle row—J. C. Armer; C. E. MacDonald; Francis H. Bell. Bottom row—E. C. Burton; A. G. Storie; Rex E. Nicholson



Top row, left to right—John T. Hepburn; Lt. Col. James Mess; D. B. McCoy. Middle row—M. L. Doelman; Joseph Sully; E. H. Gurney. Bottom row—George C. Crawford; Richard C. Yates; Melville P. White

and methods of dust control. A simultaneous session on nonferrous founding, will carry papers on casting magnesium alloys and high strength nonferrous casting alloys. The complete technical program, giving papers, authors, chairmen and other features is presented on pages 22 and 23.

Due to the availability of castings plants in the district, and the ever present desire on the part of many visiting foundrymen to inspect foundries in the convention city, the plant visitation committee, composed of Canadian foundrymen under the chairmanship of Melville P. White, manager of works, Canadian General Electric Co. Ltd., Toronto, is preparing a list of plants which will be available for inspection at certain times during the convention. As will be noticed in the complete program of activities during convention week, both Tuesday and Wednesday afternoons may be available for plant visitations.

Plants Open to Visitors

The following plants were included on the list for visitation at the time this issue went to press: Toronto Hardware Mfg. Co. Ltd., Toronto, soil pipe and fittings, range boilers, tanks, water heaters, etc.; Anthes Foundry Ltd., Toronto, soil pipe and fittings; Canadian Westinghouse Co. Ltd., Hamilton, electrical equipment; Standard Sanitary Mfg. Co., Ltd., Toronto, sanitary ware; Fittings Ltd., Oshawa, gray iron and malleable fittings; Canadian General Electric Co. Ltd., Toronto, electrical equipment; John T. Hepburn Ltd., Toronto, general castings and sandslingers; International Harvester Co. Ltd., Hamilton, general castings of farm implements in gray iron and malleable; Dominion Wheel & Foundries Ltd., and National Iron Corp., Ltd., Toronto, centrifugally cast iron pipe; Sully Brass Foundry Ltd., general brass and aluminum castings; Steel Co. of Canada Ltd., Hamilton, blast furnaces, coke ovens, open hearth steel plants, sheet mills, etc.; Anaconda American Brass Ltd., brass mills; and the Ontario Research Foundation.

Information on Visitation Program

Full details of the plant visitation program will be available at the registration desk in the Royal York. The committee probably will arrange to have certain plants in Hamilton ready to receive visitors who may desire to stop over on the way to the convention in Toronto. Information on that phase of the visitation program may be secured prior to the convention from the headquarters of the American Foundrymen's association, 222 West Adams street, Chicago.

The final curtain on the 1935 revue falls at 1 p.m., Friday, Aug. 23. The epilogue takes the form of the Canadian National Exhibition, the largest yearly show of its kind on the continent, which opens at noon on Friday, Aug. 23. Gathered from the far corners of the earth, the displays, housed in permanent buildings just a short distance from the hotel, should prove exceedingly interesting and attractive for the visiting foundryman. Surely, a more fitting climax to a marvelous foundry week program could not have been provided.

Crossing Border Presents No Difficulties

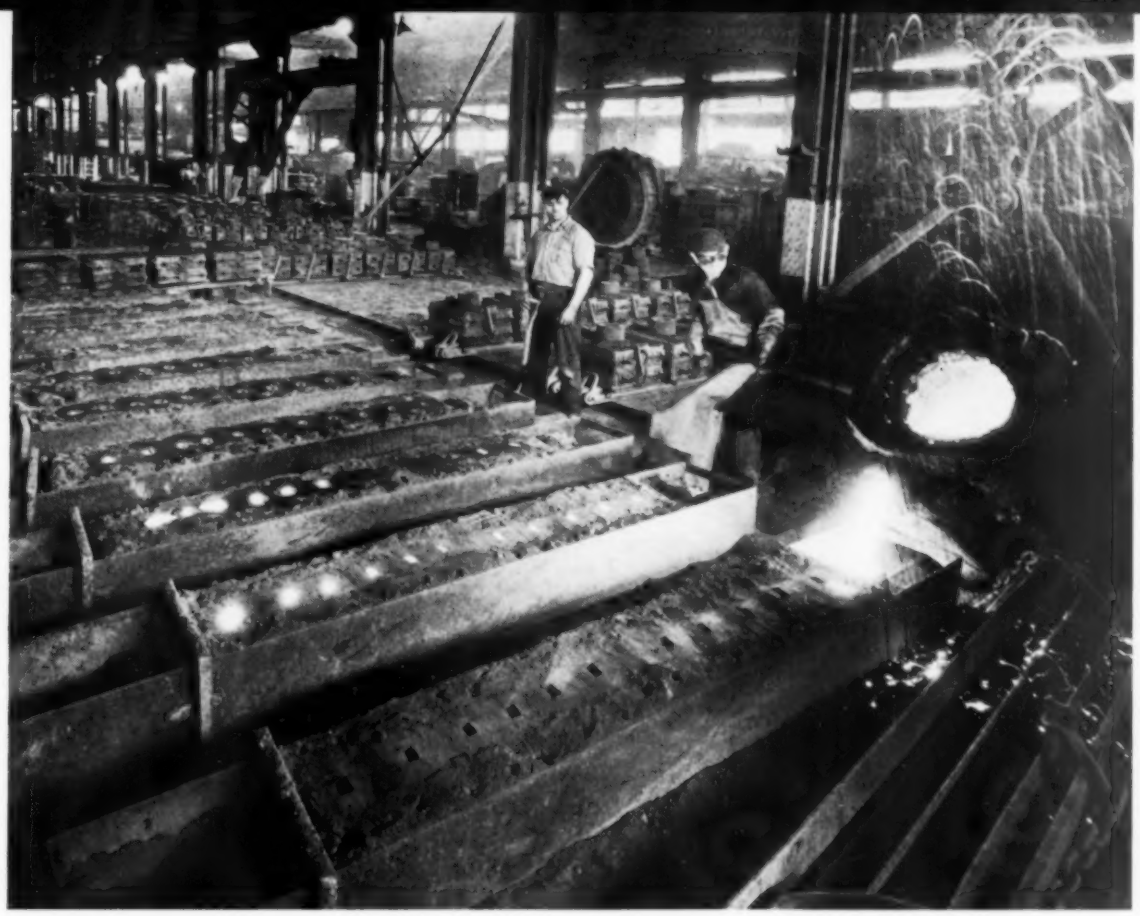
FOUNDRYMEN from the United States driving to Toronto for the annual convention of the American Foundrymen's association will find no difficulty in entering Canada, providing, of course, that the few regulations are complied with. No Canadian motor license, birth certificate, or head tax is required to enter Canada for tour of 6 months or less. Citizens of the United States must have the state license card for the car they are driving to show the Canadian customs officer at the port of entry.

Arriving at the border, the United States citizen first should go to the United States customs and fill out some papers. Then he should go to the Canadian customs and report that he is attending the A.F.A. convention at Toronto. Asked if he is going to drive the car for business purposes, the answer should be "No, for health and pleasure." If there is any possibility of leaving Canada at a different port of entry, do not leave the state license card, but secure a tourist permit.

The Toronto Convention and Tourist association has provided numerous facilities for the motoring visitor. As mentioned in the July issue of The Foundry, an interesting booklet giving information on Ontario and Toronto, as well as a road map of the lakes region, may be had free by addressing the association at Hotel Waverly, Toronto. The association also maintains a free information office at 13 West Falls street,

Niagara Falls, N. Y., where information on roads, points of interest, etc., may be obtained.

One of the most valuable features is the information office, Lake Shore boulevard, near the western city limits of Toronto, where motorists arriving on Route 2 from Detroit, or Niagara Falls, can obtain complete information on Toronto. The office is shown in the accompanying illustration. The association would appreciate having each foundryman visit this unusual information bureau.



TORONTO LEADS AS FOUNDRY CENTER

SINCE Toronto, capital and largest city of the Province of Ontario, is the leading manufacturing center of the Dominion of Canada, the production of castings naturally occupies an important position among the industries of that growing metropolis. The large total of manufactured goods produced in the city would not be possible without the generous use of castings, both as materials of construction for the final products, and for the various machines used in the manufacturing operations.

National Expansion Provides Markets

Constant expansion of Canada, the building of new homes, and the growth of cities, towns and villages with the consequent development of industrial and business sections, provides a market for castings used in the construction industry and by municipalities. Prominence of agriculture in the Dominion constantly broadens the market for agricultural implements, thus increasing the demand for castings. In fact, the basic character of the foundry industry in a prosperous, growing country is well illustrated in Canada today.

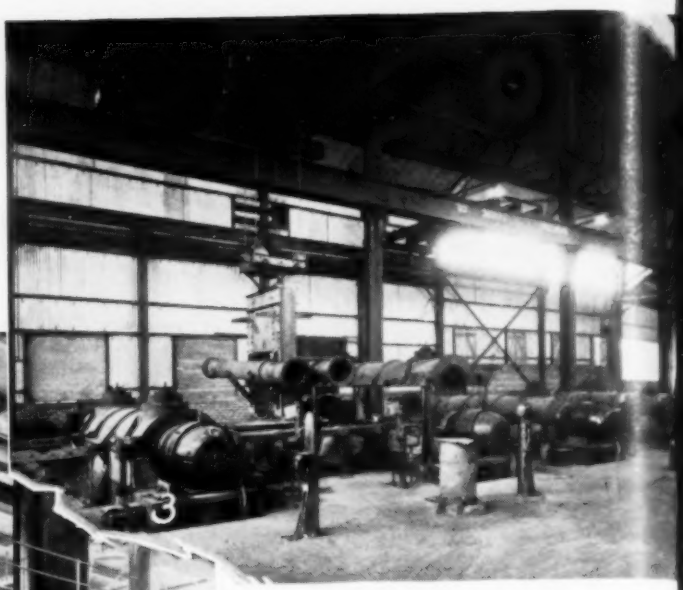
The city of Toronto, with a total of 49 foundries, holds the distinction of being the largest foundry center in Canada. Many of these foundries are large and exceptionally well equipped. At the same time, the city stands twelfth among the leading foundries cities of the North American continent.

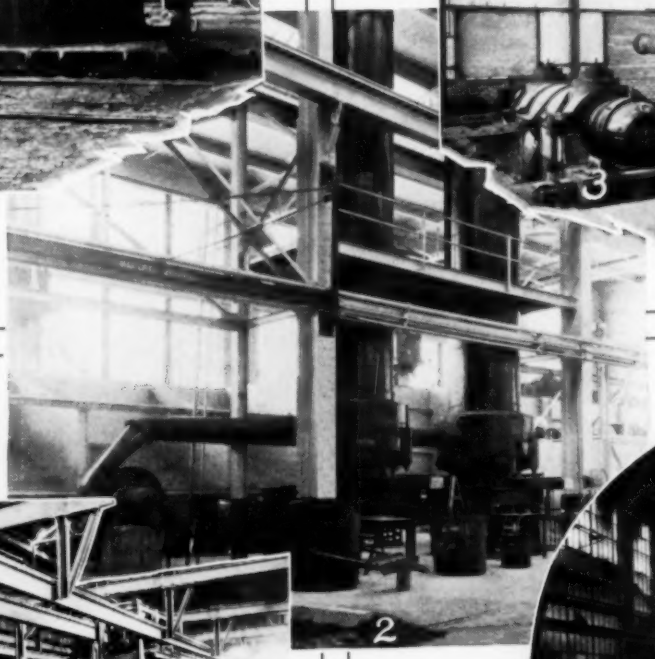
Manufacture of castings is not limited to the city of Toronto, but likewise constitutes a most important activity throughout the entire industrial or southern section of Ontario. According to a recent count made by THE FOUNDRY, the Province has a total of 263 foundries, by far the largest number in any of the provinces, and exceeded only by six states of the U. S. A.

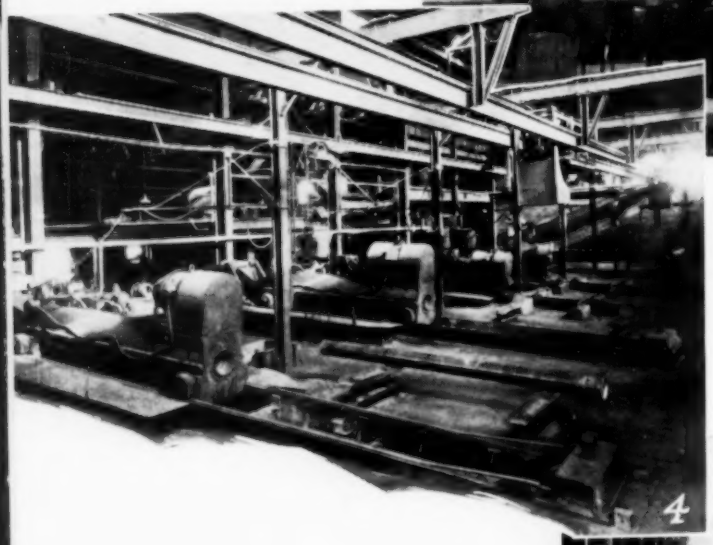
Interesting foundries may be found in numerous cities located in what might be considered the Toronto district, including Alliston, Aurora, Brantford, Brampton, Cobourg, Dundas, Galt, Guelph, Hamilton, Kitchener, Niagara Falls, Peterboro, Port Hope, Preston, St. Catharines, Welland and many others. Several of these plants are shown in the accompanying illustrations, and a key identifying the companies represented is presented on page 32.

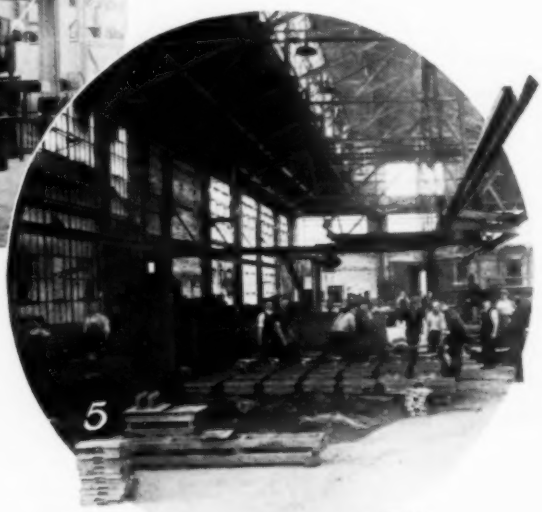
Castings Made in Wide Variety

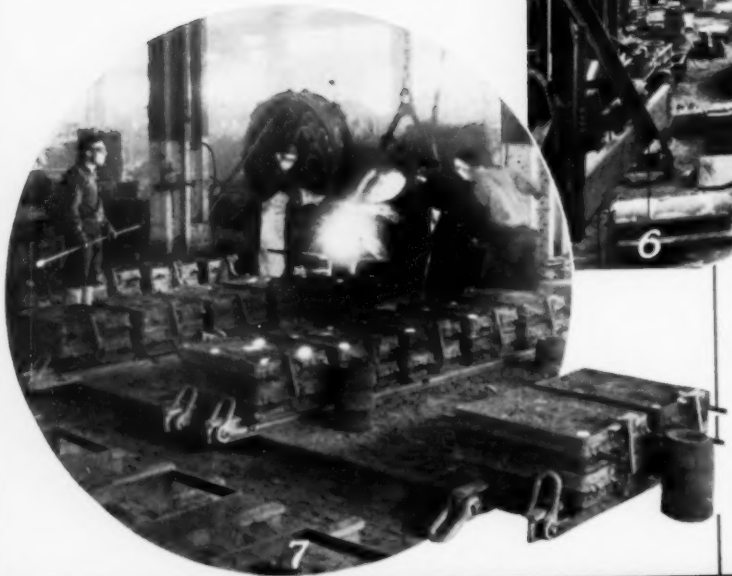
Following closely the pattern established by the industries in the district, the classes of castings produced are well diversified. While it is not possible to discuss in detail all of the interesting foundries in the Toronto district, mention of a few companies will illustrate the diversity of products. Several companies, such as the Canadian General Electric Co. Ltd., Toronto, the

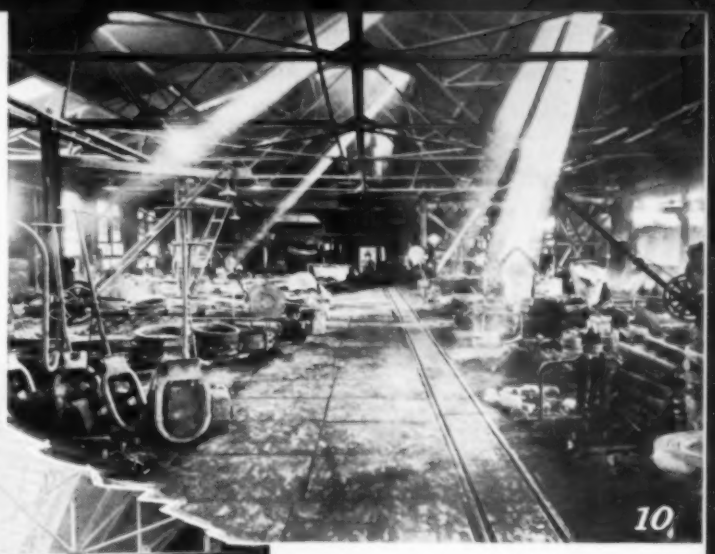




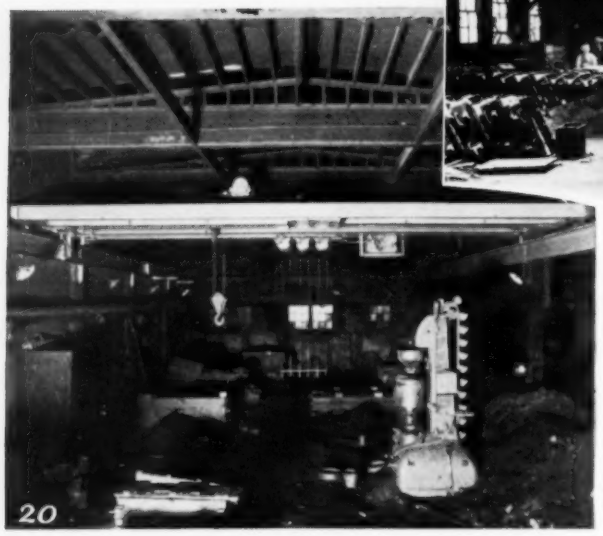








A key to the illustrations included in this article is presented on page 32



Canadian Westinghouse Co. Ltd., Hamilton, the Massey-Harris Co. Ltd., Toronto, and the International Harvester Co. Ltd., Hamilton, have built modern foundries for the express purpose of producing castings to be used in further manufacturing operations, which in these instances include the production of electrical equipment and agricultural implements.

Several companies are engaged in the production of cast iron pipe. The Anthes Foundry Ltd., with plants in Toronto and St. Catharines, Ont., Winnipeg, Manitoba and Vancouver, B. C., has soil pipe and fittings as its chief product, as has the Toronto Hardware Mfg. Co. Ltd., Toronto. The National Iron Corp. (*Please turn to page* 70)

Many Types of Foundries Located in Toronto District

IMPORTANCE of the Toronto district as a foundry center is well exemplified in the accompanying illustrations, reproduced through the kind cooperation of the various companies represented. A key to the illustrations follows:

Head illustration—pouring light castings from a small ladle—Dominion Foundries & Steel Ltd., Hamilton.

1—Molding heavy duty dry sand castings—Dominion Foundries & Steel Ltd., Hamilton.

2—Cupola installation—Canadian National Railways, Point St. Charles, Montreal.

3—Sand spun pipe equipment—Gartshore Thomson Pipe & Foundry Co., Hamilton.

4—Delavaud centrifugal pipe equipment—National Iron Corp. Ltd., Toronto.

5—Brass foundry molding floor—Canadian Westinghouse Co. Ltd., Hamilton.

6—Main bay in gray iron foundry—Canadian General Electric Co., Toronto.

7—Pouring metal from ladle to small hand shank ladles—Dominion Foundries & Steel Ltd., Hamilton.

8—Direct arc furnaces in brass foundry—Canadian Westinghouse Co. Ltd., Hamilton.

9—General view—Canadian Westinghouse Co. Ltd., Hamilton.

10—Main foundry bay—Dominion Wheel & Foundries Ltd., Toronto.

11—Bay in gray iron foundry—Waterous Ltd., Brantford.

12—Hand pouring small castings—Dominion Foundries & Steel Ltd., Hamilton.

13—View of dry sand molding bay—Dominion Foundries & Steel Ltd., Hamilton.

14—Coring and closing dry sand molds—Dominion Foundries & Steel Ltd., Hamilton.

15—Pouring dry sand molds—Dominion Foundries & Steel Ltd., Hamilton.

16—Patternshop—Fittings Ltd., Oshawa.

17—Gray iron foundry—Fittings Ltd., Oshawa.

18—Brass foundry molding floor—Sully Brass Foundry Ltd., Toronto.

19—General view, gray iron foundry—Cockshutt Plow Co. Ltd., Brantford.

20—Sandslinger shop—John T. Hepborn Ltd., Toronto.

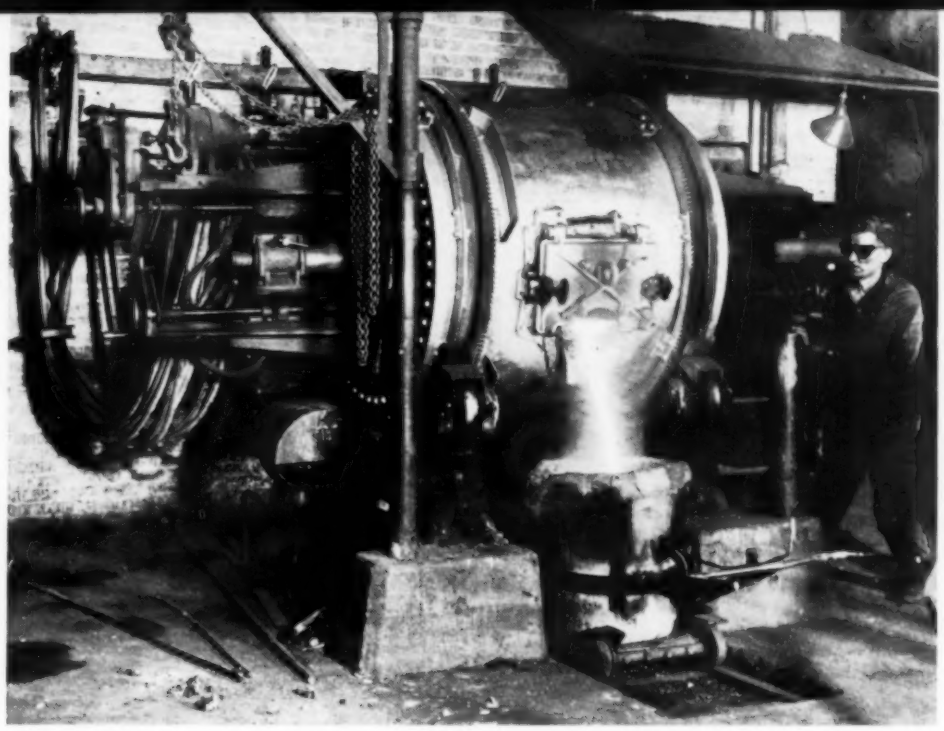


Fig. 1—Metal was superheated in an indirect arc electric furnace

SUPERHEATING CUPOLA MELTED IRON

By GARNET P. PHILLIPS

THE theory has been advanced and rather widely accepted that molten cupola melted metal, when made with raw materials containing graphite particles, contains some undissolved graphite particles which act as nuclei for precipitation of further graphite of rather coarse size during cooling of the metal. It also has been stated that superheating of such molten metal will cause all graphite to dissolve, thus removing nuclei and obtaining finer and better distributed graphite particles when the metal is cooled and that, as a result, better physical properties are obtained.

During the course of some experimental work on cylinder liner and manifold castings, the author collected some data on the effects of superheating cupola melted metal in an indirect arc, rocking electric furnace. Three series of tests were made on the following cupola melted metals: First series, nickel-chromium alloy metal—cupola mixture contained 20 per cent steel, 37 per cent pig iron and 43 per cent scrap iron; Second series, contained small amount of incidental nickel and chromium—cupola mixture contained 53 per cent pig iron and 47 per cent scrap iron; Third series, nickel-chromium alloy metal—cupola mixture same as first series.

In all tests, a calibrated optical pyrometer was used to determine metal temperatures. Corrections for emissivity were made on all readings taken in the open. The superheat temperatures obtained on the metal bath in the electric furnace were taken directly on the bath, cleared of slag, through the tap hole and no corrections were applied.

In the first series of tests, duplicate transverse test bars and duplicate cast tensile test bars poured with the metal as it came from the cupola, after superheating in the electric furnace and another set after superheating and cooling in the ladle. Chemical analyses were obtained on the cast tensile bars which were 0.675-inch diameter at the center as cast and 0.600-inch diameter after machining. Hardness tests were made on the ground fractures of both the transverse and tensile bars. In the case of the transverse bars, which were 1.20-inch diameter, a brinell test was made midway between center and edge and four Rockwell *B* tests made also midway between center and edge. In the tables the hardness tests given are for a single brinell test and the average of four Rockwell *B* tests for the

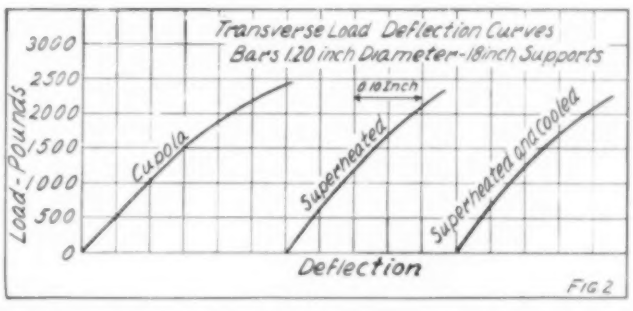


Fig. 2—Transverse load-deflection curves for the first series of tests

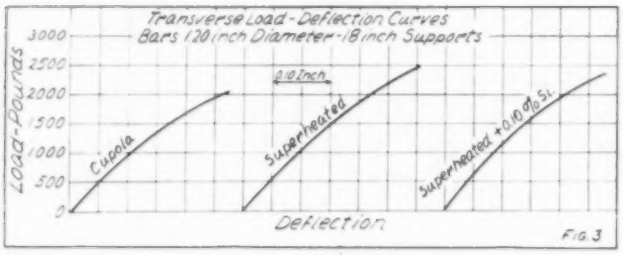


Fig. 3—Transverse load-deflection curves for second series of tests

transverse test bars, while for the tensile bars the brinell test given is the average of two tests and the Rockwell *B* test given is the average of eight tests.

Temperature of the cupola melted metal was 2845 degrees Fahr. at the cupola spout. The test bars poured with this metal were poured in the temperature range 2610 to 2568 degrees Fahr. Temperature of the superheated metal in the electric furnace was 2993 degrees Fahr. and the test bars were poured with it at slightly under 2900 degrees Fahr. The third set of bars was cast with the superheated metal after being cooled in the ladle and was poured in the temperature range 2630 to 2560 degrees Fahr. The chemical analyses and physical properties obtained are given in Table I, and transverse load-deflection curves are given in Fig. 2.

In making chemical analyses total carbon and graphite determinations were made in duplicate. The transverse resilience was determined by the method of least squares from the transverse load-deflection curves. The modulus of rupture was calculated from the transverse test and the modulus of elasticity was calculated from the transverse test data at 25 per cent ultimate load. It should be noted that about 0.20 per cent silicon was added to the cupola melted metal at the spout to obtain the silicon content given in the table. This happened to be standard practice for the production of that particular iron.

A study of the data as obtained on the first series of tests shows that electrically superheating has resulted in a slight decrease in silicon, a decided increase combined carbon with a corresponding decrease in graphite content and an increase in hardness. Superheating has increased tensile strength only slightly but has decreased transverse strength, deflection and resilience markedly. Superheating has decreased modulus of rupture and increased the stiffness of the metal as shown by values for relative modulus of elasticity at 25 per cent ultimate load.

It was noted that castings poured with the different irons of the first series showed considerably more chill at ends when poured with the superheated metal even after cooling in the

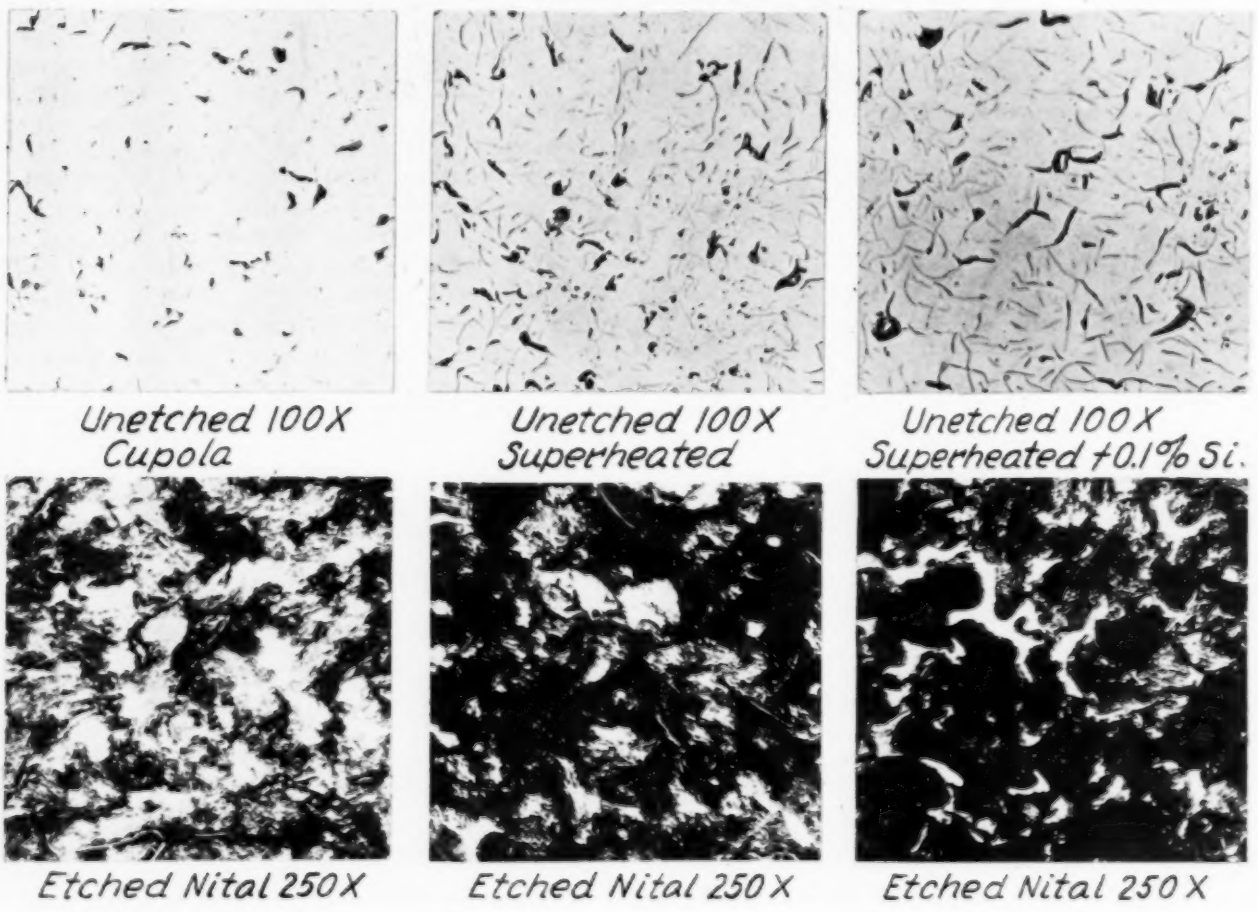


Fig. 4—Micrographs of specimens taken from the cast tensile bars of the second series

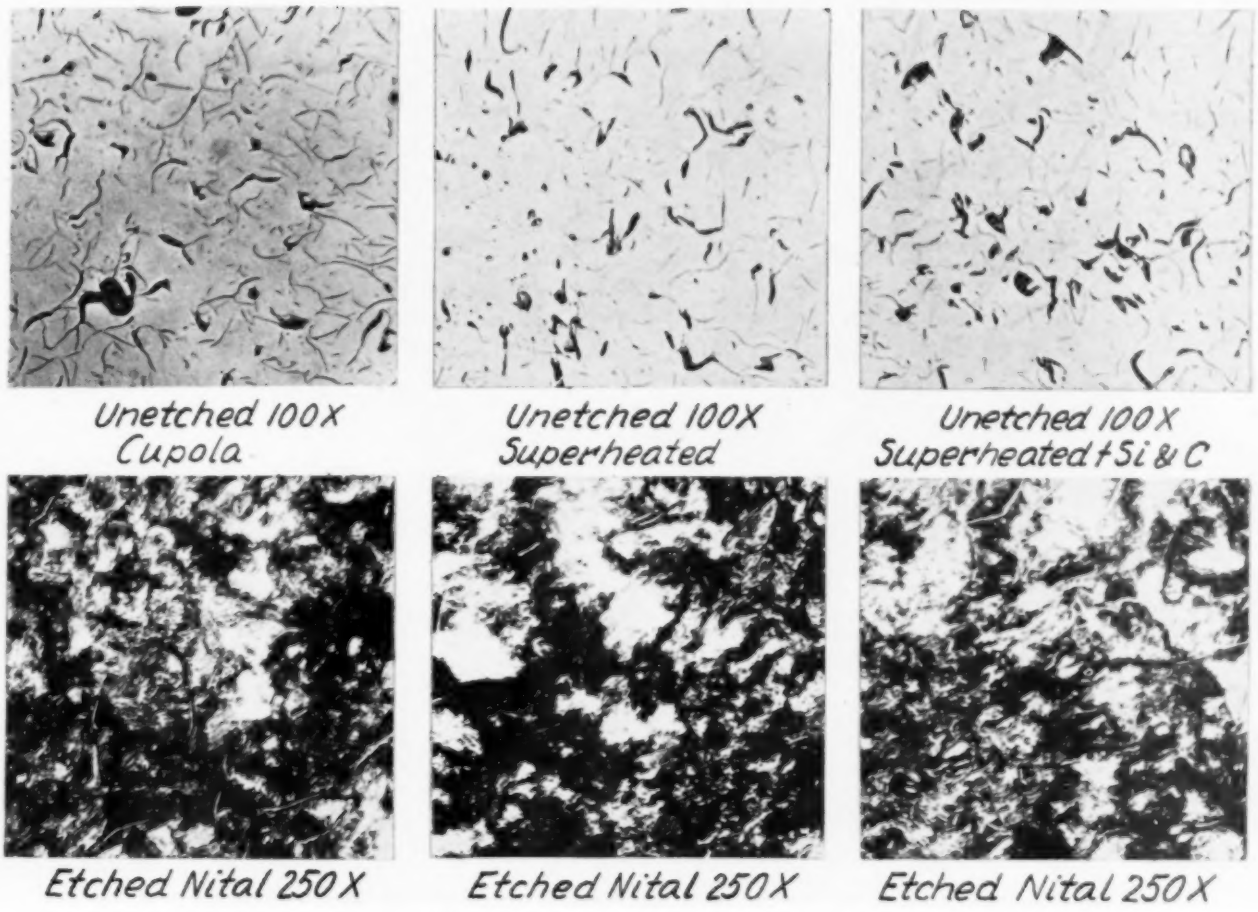


Fig. 5—Micrographs of specimens taken from the cast tensile bars of the third series

ladle as compared to those poured with the cupola melted metal.

The second series of tests was made on an iron that was made with a pig iron scrap mixture in the cupola with no steel in the mixture. Samples for analyses were taken just as in the first series and all other tests also were made in a similar manner. The cupola melted metal had a temperature at the spout of 2800 degrees Fahr. and test bars were poured with it in the temperature range 2400 to 2350 degrees Fahr. The superheated metal in the electric furnace was at a temperautre of 2970 degrees Fahr. and test bars were poured with it at 2900 degrees Fahr. and slightly under. A third set of bars was poured after adding about 0.10 per cent silicon to bath in the furnace at a temperature range of 2400 to 2350 degrees Fahr. The silicon was added to offset the increase in chill depth noted on the superheated metal. Chemical analyses and physical test data are given in Table II while transverse load-deflection curves are given in Fig. 3.

Micrographs of the second series are shown in Fig. 4. Specimens were taken from the cast tensile bars which were 0.675-inch diameter as cast. The unetched micrographs showing graphite particle size and distribution are at 100 magnification while the nital etched micrographs showing structures are at 250 magnifications.

Superheating in the case of the second series has resulted in a slight decrease in silicon and total carbon with little change in graphite and combined carbon. The physical properties were all raised by superheating, the unit increase in transverse resilience being notable. After the small silicon addition to the superheated bath the physical properties are still superior to those of the cupola melted metal.

The third series of tests was made on fairly high nickel-chromium alloy iron made with a steel-mix cupola melted metal as noted previously. Samples for chemical analyses were taken from cast tensile bars as in previous series and other tests were made (*Please turn to page 72*)

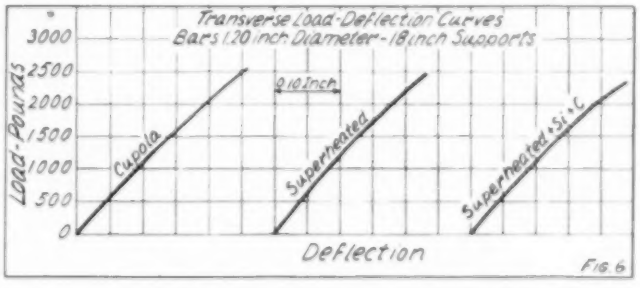


Fig. 6—Transverse load-deflection curves for the first series of tests

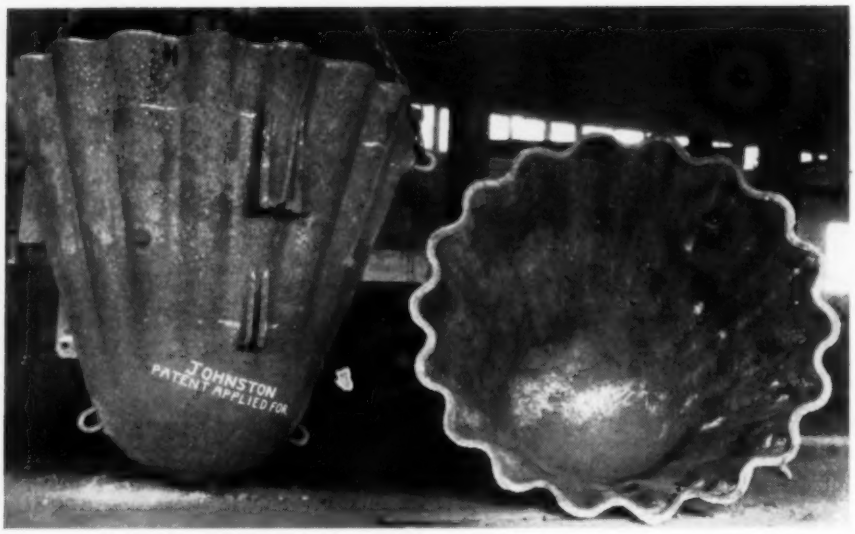


Fig. 1—Corrugated wall on slag ladle facilitates contraction and expansion and thus prolongs life of the casting

Hardens Steel Roll Surfaces

Application of torch and spray imparts extreme hardness to face of alloy steel

By PAT DWYER

IN ADDITION to the roll and miscellaneous gray iron foundry operated by the Mackintosh-Hemphill Co., in Pittsburgh, the company also operates a large foundry in Midland, Pa., devoted to the production of carbon and alloy steel rolls, rolling mill and miscellaneous steel castings, and special alloy iron castings.

A row of columns in the center divides the building, 150 x 730 feet, into two main bays, one devoted to the production of steel castings, and the other to the production of special high test alloy iron castings. Metal for both divisions is melted in one 25 and one 35-ton open-hearth furnace located in an addition to the main building at one end. Mold drying ovens, casting pits and the floor for setting up the dried molds occupy space near this end of the building in the steel foundry bay. The main molding floor and the core room are located in the center of the bay, while the remainder of the space is given over principally to machines for removing the heads from, and finishing the rolls. Four large annealing furnaces are located between the dry floor and the core room and the bay is spanned by five traveling cranes, one 10-ton, one 15-ton, two 25-ton, and one of 35-ton capacity.

The second bay is spanned by three cranes, two of 5-ton and one 20-ton capacity. Approximately half the floor space is devoted to the

Fig. 2—In railroad service the ladle is supported in a cast steel belt

molding of iron castings. Cores are made and dried at one end and at one side of this space. The remainder of the floor space in this bay is occupied by an annealing department with furnaces at one side, chipping and cleaning department and a shipping department with depressed track to accommodate three cars. Castings from both bays are inspected, loaded and shipped from this section. Normal capacity of each of the two acid lined open hearth furnaces is 25 to 35 tons, but the actual amount melted per heat fluctuates widely depending on many factors, including the volume of business and the special characteristics of the castings in process of production at any given time. Under pressure of circumstances, the heat in the furnaces may represent any weight between 10 and 35 tons. Similarly the operation of the furnace may be retarded or accelerated to secure one or three heats in each 24-hour day. Unlike other melting mediums an open-hearth furnace is held continuously at a high temperature until it has to be cooled down for repairs. The furnaces are equipped to burn either oil or natural gas.

Furnaces Are Elevated Above Floor

The furnaces and charging platform are elevated a considerable distance above the floor level so that the ladle mounted on a low buggy may be placed under the tapping spout. Since this section of the foundry is not spanned by a crane, the buggy is moved by a cable and winch to a point on the track extending into the main bay where the ladle may be picked up by one of the cranes.

Alloy iron heats also are melted in the same furnaces. In one of these instances the buggy and ladle are moved to a point in the track where a turntable diverts the ladle to a crosstrack leading into the second bay of the foundry. In this second bay the ladle is placed upon suitable stands and the contents distributed in a small ladle by one of the cranes over a wide range of small molds. The initial temperature of the metal in the ladle is approximately 2800 degrees Fahr., and the pouring time is about 1½ hours. Further reference to activities in this section of the foundry devoted to the production of small alloy iron castings will be taken up later.

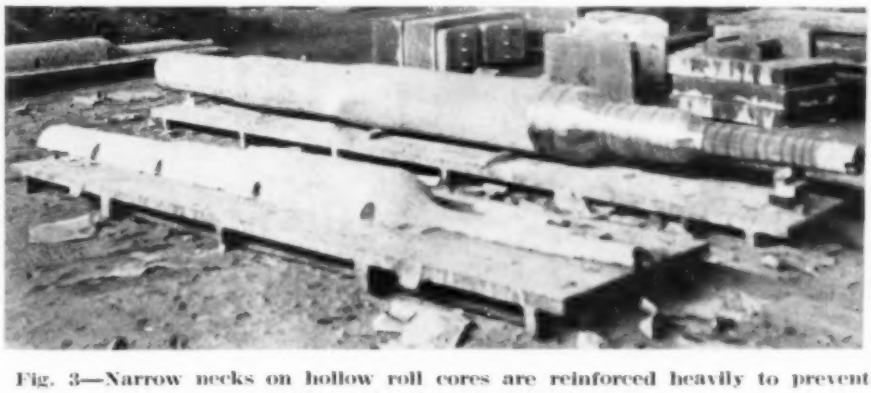


Fig. 3—Narrow necks on hollow roll cores are reinforced heavily to prevent the metal from burning in

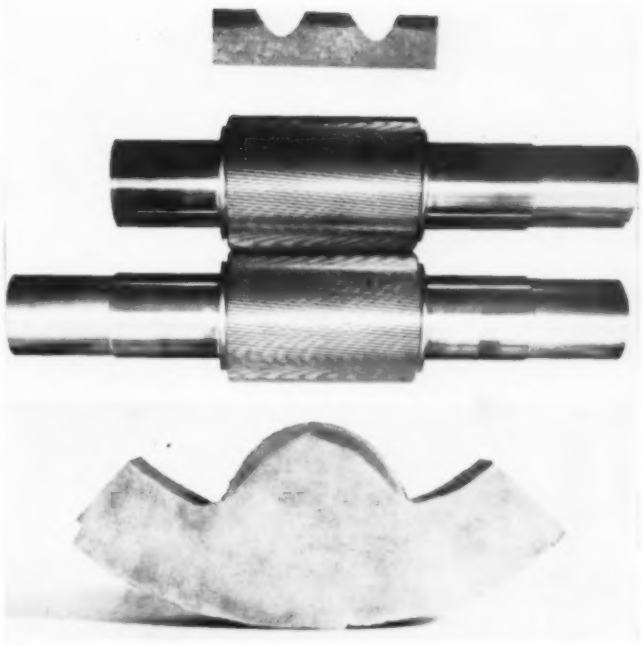


Fig. 4 (Above)—Enlarged section of hardened grooves from finished rolls in center. (Below)—Section from treated coupling box. Fractured surface ground and etched to show depth of metal affected by process

Alloy steel heats are worked in a manner similar to that employed on plain carbon steel, with the exception that the initial carbon content is sufficiently high to allow for at least a 2-hour refining period. The necessary amount of silicon and manganese are placed in the furnace when the carbon content reaches the desired point. The furnace is tapped 20 minutes afterward.

The metal is tapped at a temperature of 2900 degrees Fahr., and poured into the molds at a somewhat lower temperature. Thus for a 0.50 per cent carbon steel the pouring temperature is 2725 degrees Fahr., while a 2 per cent carbon alloy steel is poured at 2550 degrees Fahr. Temperatures on all heats are checked by optical pyrometer.

Full patterns are employed for molding many of the smaller sizes of rolls, particularly standard sizes, or those made in considerable numbers, but the larger sizes are swept in half flasks laid down horizontally. A sweep board with the edge conforming to the outer contour of the roll is attached to a long steel spindle mounted in journals at each end of the half flask. One end of the flask is closed and the other or neck end is open. A temporary support for the journal is bolted across the open end.

Molds are made from a high grade silica sand, containing from 95 to 98 per cent silica. The facing sand is bonded with clay and molasses water and prepared for use in a pair of

(*Please turn to page* 77)

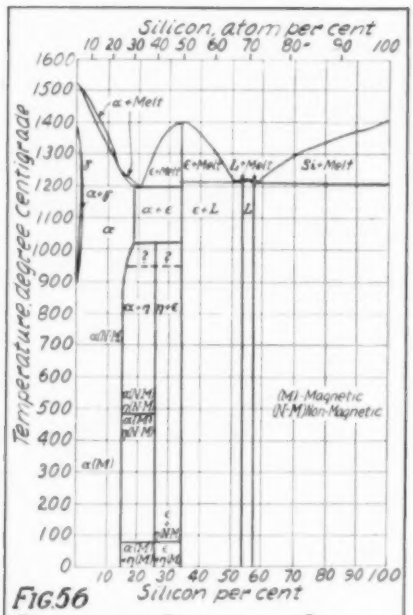


Fig. 56

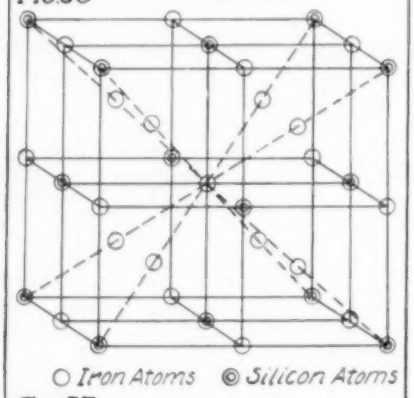


Fig. 57

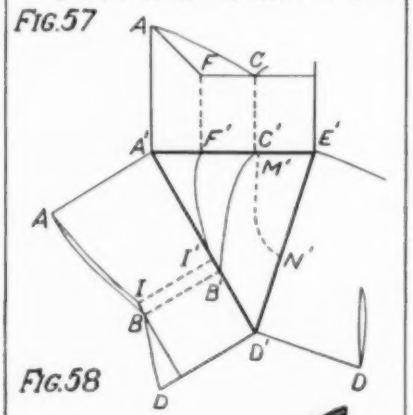


Fig. 58

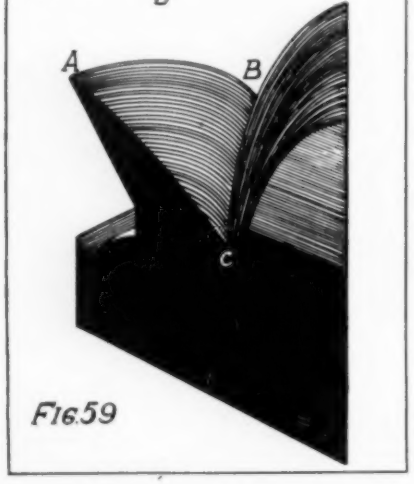


Fig. 59

GRAY CAST IRON

By JOHN W. BOLTON

Chapter III (Effects of Silicon)

GRAY irons may be defined in part as alloys of iron, carbon and silicon. Silicon itself is an element of rather low atomic weight—28.1—as compared with 55.84 for iron, and low density, 2.42, which melts at 2588 degrees Fahr. Commercially pure silicon (98 per cent) usually is composed of black or grayish plates or leaflets fused together into lumps. Pure silicon is hard (105- Rockwell C scale) and brittle. Templin gives its tensile strength as about 13,500 pounds per square inch.

Silicon found in gray irons is produced in the blast furnace through the reaction of the silicates in the ore and slag with the hot coke and reducing gases. The net reaction may be expressed by the equation:

C	plus	SiO_2	→	Si	plus	CO_2
Carbon		Silica		Silicon		Carbon Dioxide

The actual reactions are somewhat more complex.

Silicon Affects Graphitization of Iron

Little was known about the effects of silicon on cast iron until the publication of the now classic memoirs of Prof. Turner in 1885 and 1886. Among other things these researches indicated clearly the softening action resulting from graphitization produced by increase of silicon. Indeed it is maintained by some that graphitization does not take place unless at least traces of silicon are present. Under otherwise constant conditions the relative percentages of combined and graphitic carbon can be regulated by variation of silicon percentage. Since the mechanical properties of gray iron are in large measure dependent on the relative amounts of these components, silicon can be used to help regulate the mechanical properties. It is only within the last 12 or 15 years that foundrymen in general have paid much attention to the influences of total carbon content and methods for its control. Prior to this period the properties of most foundry irons were *controlled* almost entirely through regulation of silicon content. Today modern foundrymen realize that more complete control of mechanical properties is obtainable by regulating both silicon and total carbon content.

Iron and silicon form a continuous series of solid solutions within the ranges of silicon content used in gray iron alloys. The iron silicon diagram of Haughton and Becker—*Journal*, Iron and Steel Institute, 1930— is shown in Fig. 56. Phragmen's X-ray studies indicate that the original body centered type structure of alpha iron is retained up to about 14.3 per cent silicon, there being a slight decrease in parameter with increase in silicon content. The occurrence of silicon atoms substituting iron atoms in the alpha iron lattice is shown in Fig. 57. According to Phragmen, who constructed that diagram, a face centered cubic super-lattice with twice the parameter of the alpha iron lattice is formed.

Fig. 56.—The equilibrium diagram developed by Haughton and Becker. Fig. 57—Occurrence of silicon atoms substituting iron atoms in the alpha iron lattice, according to Phragmen. Figs. 58-59—Early ternary diagram by Gontermann

Due to the fact that the silicon is held in solid solution, there is no marked change in the microstructure of pure iron containing that constituent within the percentages found in the commercial gray iron alloys. The general action of the silicon is to harden and strengthen the iron somewhat, and to increase its corrosion resistance slightly. There apparently is little effect on ductility.

The early ternary diagram by Gontermann—*Zeit. fur anorg. Chemie*—Vol. 59, 1908, pages 373-413—of the system iron-carbon silicon is shown in Figs. 58 and 59. In these illustrations the binary iron carbon diagram has been drawn to 4 times the scale of the iron-silicon binary diagram.

Features Open To Controversy

The upper surface of the model Fig. 59 by Gontermann represents the liquidus surface of the ternary alloys. The vertical face toward the reader represents the iron carbon system. Fig. 58 is a projection of the liquidus and solidus surface of the model figure. The upper diamgram A-A^1-E represents the iron carbon diagram, the diagram AA^1D^1D represents the portion of the iron silicon diagram. This diagram has been superseded by later and more accurate diagrams, but is included for purposes of exposition. Study of the exact nature of the iron-silicon and iron-silicon-carbon systems is interesting and important. However, such study is rather involved and there is considerable controversy regarding various features of these systems.

Other diagrams are those of Honda and Murakami, *Science Reports*, Sendai, Series 1, vol. 12, 1923, pages 257-288, (silicon up to 24.7 per cent); Hanson—*Journal Iron and Steel Institute*, vol. 116, 1927, pages 129-183 (silicon up to 2 per cent, carbon to 4 per cent); Kriz and Poboril—*Journal Iron and Steel Institute*, Vol. 122, 1930, pages 191-213, and *Coll. of Czechoslavak Chem. Comm.* Vol. 3, 1931, pages 61-72. Study of chapters VII and VIII of the monograph, *Alloys of Iron and Silicon* by Greiner, Marsh, and Stoughton is suggested to those who wish to go into this subject in detail.

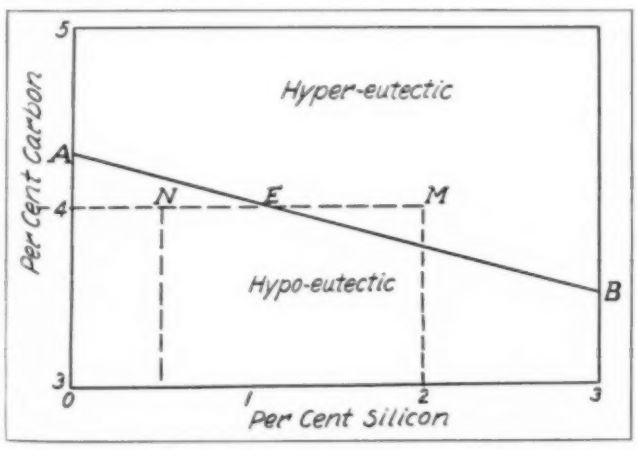


Fig. 60—Influence of silicon content on the percentage of carbon in the eutectic alloy, from results of Wust & Peterson charted by Professor Sauveur

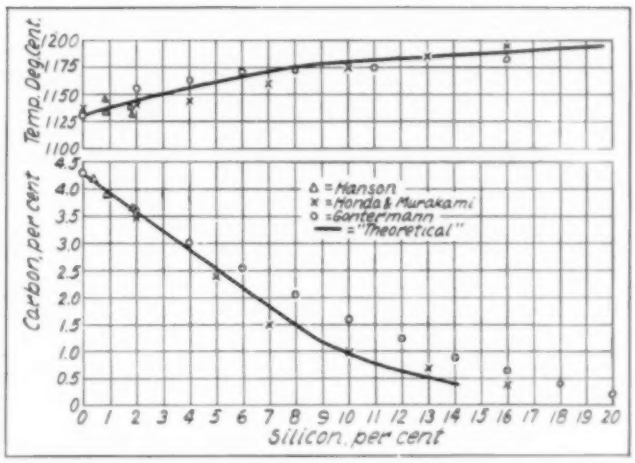


Fig. 61—Concentration and temperature variation of the eutectic, from a diagram constructed by Greiner, Marsh and Stoughton

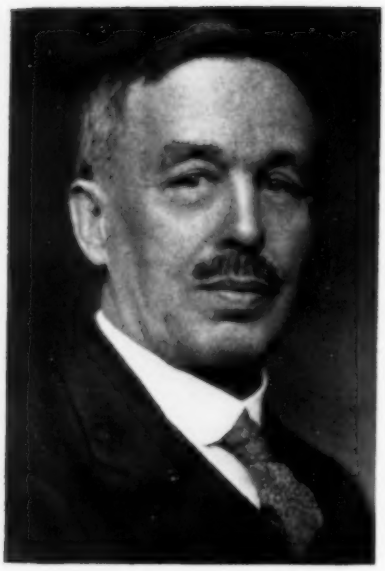
The main or principal effects of silicon in the iron-silicon-carbon alloys are as follows:

1—The eutectic percentage of carbon, normally 4.3 per cent carbon in straight iron carbon alloys, is lowered progressively with increase in silicon. This first was shown by Wust & Peterson—*Metallurgie* Vol. III, 1906, pages 811-820 Their results, plotted in chart form by Prof. Sauveur are shown in Fig. 60. This indicates that the eutectic percentage of carbon is lowered slightly less than 0.30 per cent carbon for each 1 per cent silicon. Actual findings of Wust & Peterson are shown in Table I. This trend is indicated by the ternary system model constructed by Gontermann and by the work of Honda and Murakami—*Journal Iron and Steel Institute*, Vol. 1, 1923. It has been confirmed more recently by Schichtel & Piwowarski—*Archiv fur Eisenhuttenwesen*, pages 3-139, August, 1929. They show that the eutectic concentration is lowered 0.28 per cent for each 1 per cent of silicon. Results of others are in fair agreement with Wust and Peterson and Schichtel and Piwowarsky, but indicate a somewhat more rapid lowering of carbon in the eutectic with silicon increase.

Silicon Affects Physical Properties

The position of this eutectic has an important bearing on the microstructure and possible physical properties of gray irons, hence the effect of silicon percentage in this respect must be taken into account.

It has been stated previously that the hypereutectic cementite of molten hypereutectic irons breaks down rather readily forming free graphite or kish, and that tendency of most pig irons is to approach an *eutectic analysis*. Taking this and also the effect of silicon into account it is not surprising to find that as a rule high silicon pig irons are somewhat lower in carbon than low silicon irons. This (*Please turn to page* 80)



H. Winterton
Senior Vice President

J. E. Hurst
President

C. W. Bigg
Junior Vice President

I. B. F. Holds Annual Conference

By VINCENT DELPORT
European Manager, The Foundry

AFTER an interval of eight years, Sheffield again was the seat of the annual convention of the Institute of British Foundrymen. As one of the most important steel centers of Europe, and, from the point of view of special steels, probably the most important center of the world, Sheffield was this year able to receive the conference delegates in a much more hopeful atmosphere than in 1927.

The opening meeting, preceded by a civic reception on the previous evening, was held at the Mappin hall, University of Sheffield, on Wednesday, July 3. Seated on each side of Roy Stubbs, the retiring president of the Institute, were the vice-chancellor of the University of Sheffield, Alderman Dr. A. W. Pickard-Cambridge, the Lord Mayor of Sheffield, Alderman P. J. M. Turner, the Master Cutler, A. Williamson, the Provost and Archdeacon of Sheffield, and the president of the Sheffield chamber of commerce, A. K. Wilson.

The Lord Mayor, in the address of welcome, mentioned the harmonious relations existing between the leaders of industry in Sheffield and the university. In referring to the recent years of industrial depression, during which over £1,000,000 a year was spent on unemployment, he stated that the recovery that has taken place in the last years has been helped greatly by the cooperation between the university and industry. Immediately after his address, the Lord Mayor presented the meritorious services medal of the institute to H. Bunting, who for 20 years was honorary secretary of the East Midlands branch.

The Master Cutler then addressed the meeting on behalf of the Cutlers' company, one of the most ancient companies of the country. He referred to the improved conditions in the steelworks of Sheffield, which developed concurrently with the re-establishment of better trade conditions. He then referred to the work of Sir William Larke, who was to deliver the first Edward Williams lecture, and said that he largely was responsible for the recovery of the steel industry. The Master Cutler was followed by the president of the Sheffield chamber of commerce, who also said a few words of welcome.

The ceremony of the induction of the new president then took place, and J. E. Hurst, Sheepbridge Stokes Centrifugal Castings Co., Ltd., received the badge of office from the hands of Roy Stubbs. Mr. Hurst first announced the results of the election of officers for the ensuing year: Senior vice president, H. Winterton, Wm. Cumming & Co., Ltd.; junior vice president, C. W. Bigg, Qualcast, Ltd., and the names of members elected to the council of the institute: P. A. Russell, East Midlands branch; Prof. J. H. Andrew, Sheffield branch; D. H. Wood, Birmingham branch; E. Longden, Lancashire branch; V. Delport, London Branch; R. A. Miles, Lancashire branch.

Tom Makemson, secretary of the institute, read messages of greetings received from Emile Ramas, president of the Association Technique

de Fonderie, of Paris, J. Leonard, president of the Association Technique de Fonderie, of Belgium, Frank G. Steinebach, chairman of the committee on international relations of the American Foundrymen's association, and Prof. Piwowarski and Mr. Nipper, of the Technical High school, Aachen, Germany.

J. E. Hurst then delivered his presidential address entitled "The Heat Treatment of Cast Iron." He began by quoting a paragraph from an address given by Prof. Thomas Turner at the Birmingham conference of August, 1909, in which Prof. Turner then said: "The renewed and extended interest in cast iron came as a surprise to those who believed the days of the iron-founder to be numbered, and was a revival which was as unexpected as it was pronounced." "This paragraph," said Mr. Hurst, "written 25 years ago, will serve to concentrate our attention on the conditions as they exist today.

Reviewed Metallurgical Progress

The president reviewed the metallurgical progress of cast iron in the past 25 years, more particularly from the point of view of heat-treatment. Many pioneering experiments made in that direction were performed in the Sheffield district. Investigations on the hardening and tempering of cast iron are now being made all over the world, and all investigators agree that while hardening reduces the mechanical properties of cast iron, tempering at the correct temperature re-establishes them.

Addition of certain alloys also is being developed, and investigations are being pursued respecting the effect of these alloys on the heat treatment of cast iron, especially as regards molybdenum. Recent experiments also have shown that heat-treatment is influenced by the form and distribution of the graphite, and more investigation will be effected in that direction.

The president also referred to the more recent process of hardening cast iron by nitriding, and stated the extension of that process to a wider range of iron alloys is under way. He said the question of heat-treatment is of considerable importance, but is only one of the many developments in the metallurgy of cast iron in the past 25 years.

In closing, Mr. Hurst again quoted Prof. Turner, who in 1909 said: "Remarkable as have been the increases of knowledge during the past quarter of a century, it must not be supposed that all has been discovered, or that finality has been reached. In many directions we are yet only at the gateway of knowledge, and for the young energetic investigator who has had the requisite training and skill, the field is as wide as ever before. Rather, it should be said, it is wider, for every firm foundation securely laid is but a stone on which to build, and through each doorway, which has now been opened, the earnest student sees long corridors as yet untrod." These words, concluded the president, are just as true today as they were when they were uttered 25 years ago.

Vincent Delport
Member of Council

Delivers the First Lecture

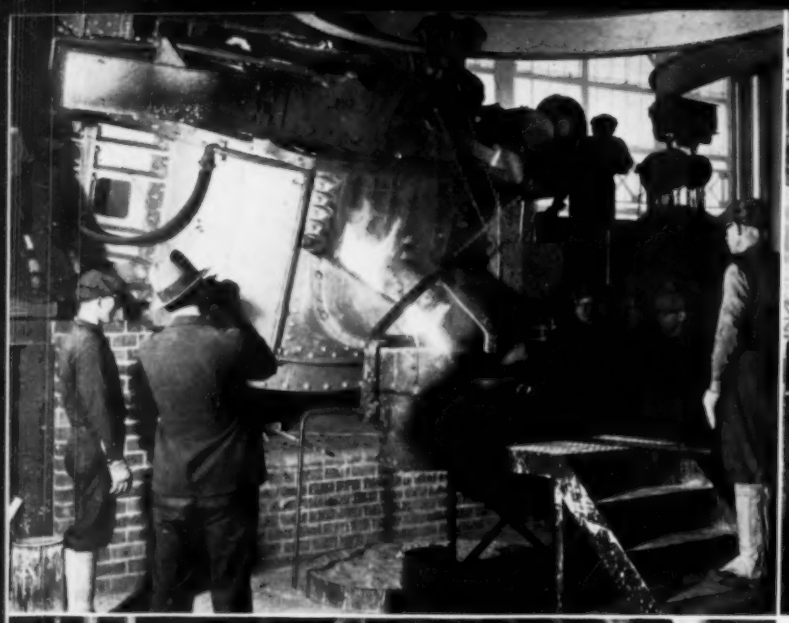
The Edward Williams lecture was instituted a year ago to commemorate the year of presidency of C. E. Williams, who was president in 1933-34 and did considerable work for the institute. The first lecture was given this year by Sir William Larke, director of the British Iron & Steel federation, and honorary member of the institute, the title being "Man and Metal."

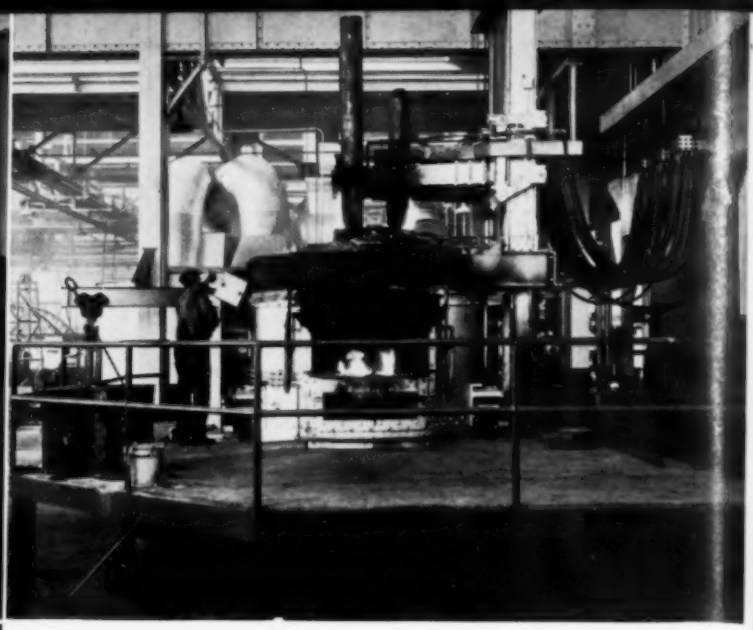
After first paying tribute to Mr. C. E. Williams, Sir William said that there is no evidence of knowledge of metals previous to 6000 or 7000 years, and the great developments connected with the machine age only took place in the past 200 years or so. The iron age does not seem to have commenced in Britain before 400 B. C., and, with the exception of the appearance of cast iron about 1340 A. D., little progress was made until the eighteenth century. Coke was first used in the blast furnace about 1735.

The main period of development started at the end of the eighteenth century and covered what might be termed the iron and coal age, the machine age, and now the electrical age.

The lecturer emphasized the fact that although the present still seems to belong to the steel age, cast iron with its special properties remains a fundamental metal. The casting stage is of primary importance respecting any metal, because it is at that stage that a metal receives the fundamental qualities that will influence its further transformations and uses. Sir William also referred to the influence exercised by manganese steel, discovered in Sheffield by Sir Robert Hadfield. Metallurgical progress in the present century is equal to that of the whole previous history of mankind, and by the continuance of research, far-reaching results can be looked for in the future.

A paper presented by W. J. Rees, head of the refractories department, University of Sheffield, was entitled: "Refractories for Foundry Use." V. C. Faulkner opened the discussion by drawing attention to the reduction of the thickness of walls of a furnace, which starts almost (*Please turn to page* 83)



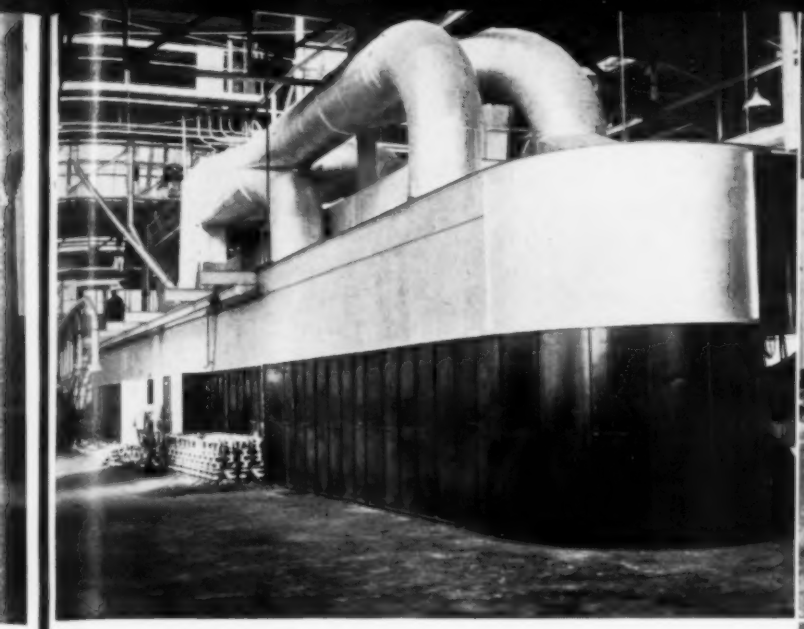


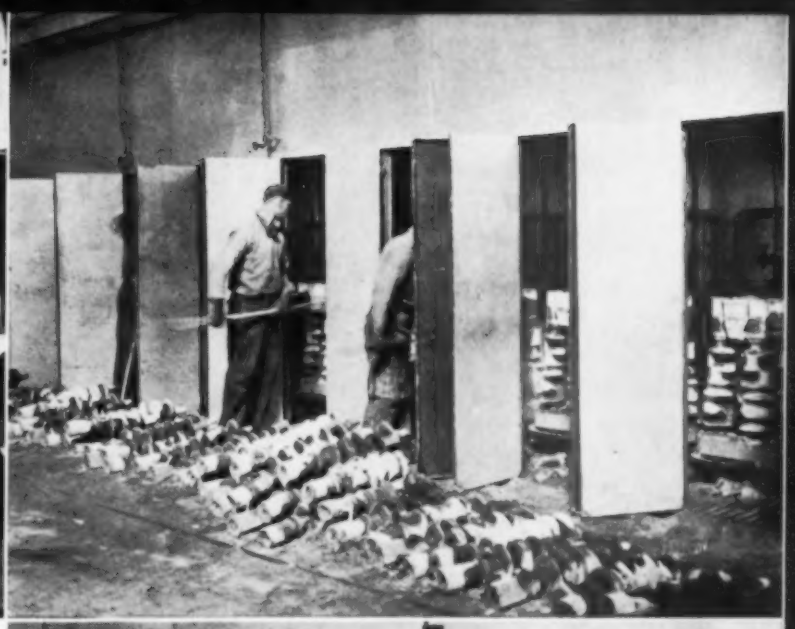
Modern Equipment Foundry

RECENTLY the Ford Motor Co. of Canada, Ltd., erected and equipped a foundry at the East Windsor plant for the manufacture of alloy steel crankshafts for the V-8 engines. The foundry is a replica on a smaller scale of a department in the huge River Rouge plant of the Ford Motor Co., where the process was developed and which was described in THE FOUNDRY, April, 1934. Approximately 100 members and guests of the Border Cities branch of the Engineering Institute of Canada attended the formal opening of the new foundry where John S. Beaumont, metallurgist of the company delivered an address on the chemical content and physical characteristics of the cast alloy steel crankshaft.

Under normal single shift operation the foundry has a capacity of 475 crankshafts to correspond with the daily production of engines. To meet increased production the foundry readily may be operated on double or triple shift with an output of 800 or 1200 crankshafts. At present five heats per day are melted in a single 9-foot diameter furnace. The furnace charge is usually 11,000 pounds and the total daily melt of metal is between 60,000 and 65,000 pounds. Of this the recovery is approxi-

Men employed in handling molten metal are protected by goggles and leggings. Metal for the crankshafts is melted in a 5-ton electric furnace and poured into molds made up of dry sand cores assembled on a pendent type conveyor





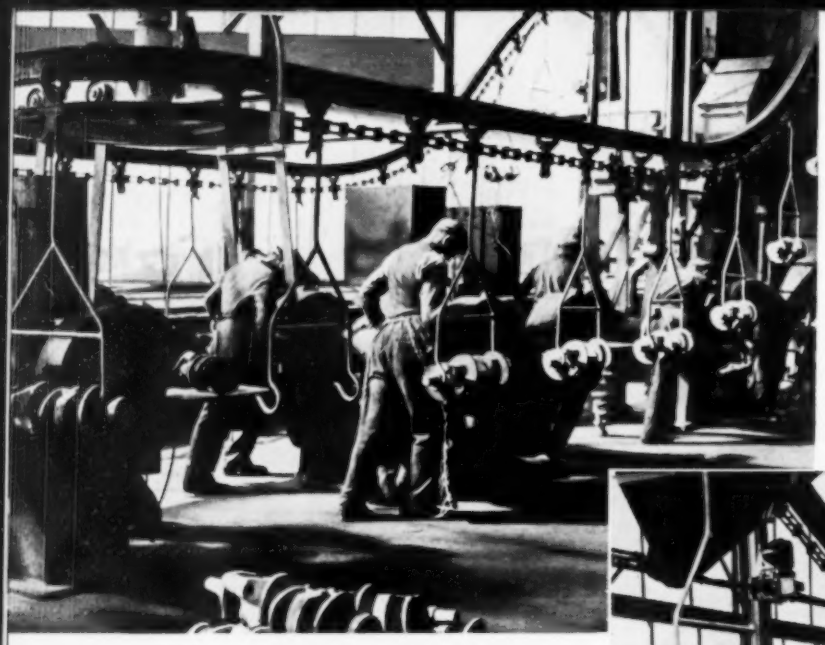
Features New Ford In Canada

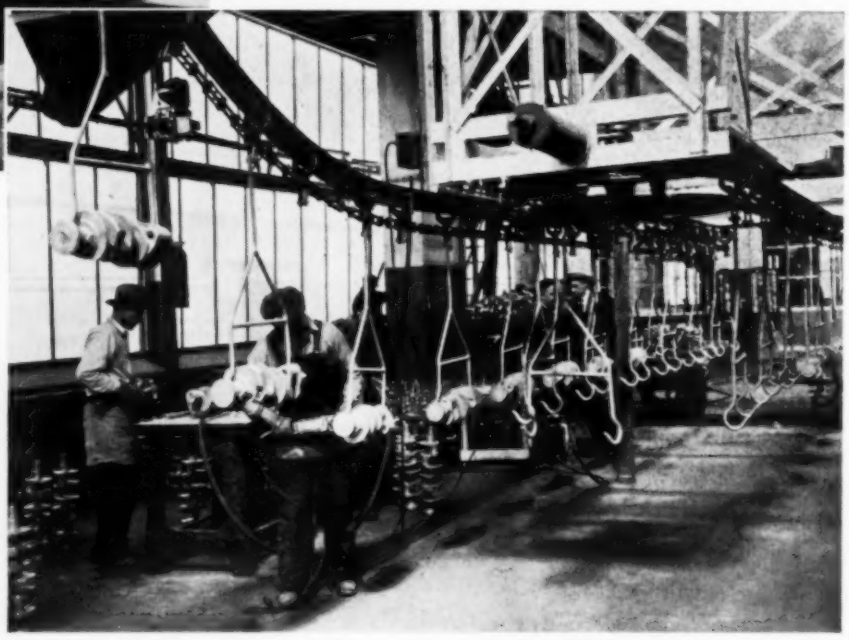
mately 58.4 per cent castings and 41.6 per cent sprue, gates and risers. Castings molded and poured in groups of 4 weigh 480 pounds. Risers and runner weigh 200 pounds, leaving a net weight of 70 pounds for each casting. This is 10 pounds lighter than the steel forging formerly employed as a crankshaft. Only 9 pounds of metal are removed from the cast shaft in the machining process in comparison to 24 pounds from the forging. The machining operations also have been reduced from 62 to 50.

The foundry building in layout, construction and equipment represents the most modern development along these lines. End and side walls are mostly glass and additional light enters through windows in the roof. The building is ventilated by powerful fans which blow air through a water spray in summer and through steam coils and a water spray in the winter. An elaborate piping system discharges fresh air to all points in the building.

After the castings are poured the molds pass through a hooded chamber from which the smoke and gas are drawn by a suction fan and discharged through the roof. That part of the floor area on which the castings are handled, approximately one third of the total, is paved

After the molds have been filled with molten metal the conveyor carries them slowly through a cooling chamber from which the gas and smoke are exhausted by a fan. Later sand, gates and risers are knocked from the castings





Above—Castings are rough ground while suspended from a conveyor on the way to the heating furnace. Right—On the return journey finishing touches are applied with portable air grinders

with wood blocks. The remainder of the floor is brick laid in cement. For purpose of description the building is made up of three main divisions. A section at one end the entire width of the building and spanned by a 5-ton crane serves as a reception depot for incoming raw material. Approximately one half the remainder of the building at one side is devoted to making and assembling the cores, pouring the metal and shaking out the castings. In the corresponding half section on the other side the castings are cleaned, inspected, heat treated and shipped.

Taking these departments in turn, loaded cars of sand enter the first section of the building on a double spur track. Sand is discharged through the bottom of the cars and falls through a grating in the floor into a large bin in the basement, sharp sand into one bin and bank sand into a second. Each bin tapers to a long narrow opening in the bottom directly over an endless belt. When this belt is set in motion it carries the sand to a second belt running transversely and serving both bins. The second belt discharges the sand into the boot of an elevator which carries the sand aloft. When bank sand is going through the system it is discharged at the top of the elevator on to a belt which carries it to a bin with a capacity of 16 tons located above a pair of muller type mixers made by the National Engineering Co., Chicago. Sharp sand going through the system is discharged from the elevator into a long revolving drum where it is dried at a temperature of 350 degrees Fahr. The drum discharges the sand on to the same belt that carries the bank sand. In this instance the sand is deflected into a bin with a capacity of 23 tons over the mullers. Both bins are in line and are provided with gates at the bottom.

A small steel box of given capacity operates on a trolley under the bins. To make up a batch of sand the box is filled with sand under the large bin, and then discharged into the muller. The operation is repeated under the second bin. Sand for the cores is mixed in the proportion of 60 parts sharp sand, 40 parts bank sand, with 1 part oil to 38 parts sand supplemented by 1 part cereal binder to 29 parts sand. The mixed sand is discharged through the bottom of the mullers on to a belt which carries it to a bucket type elevator. This elevator discharges the sand into a large circular tank which in turn through a mechanism at the bottom delivers a uniform stream of sand to the sandslinger, supplied by the Beardsley & Piper Co., Chicago. Surplus sand at the coremaking station falls through a grating in the floor and is collected on a belt which carries it back and discharges into the opposite side of the same elevator. In this manner the overflow sand automatically is placed in circulation.

For the benefit of readers who may not have seen the original article in THE FOUNDRY covering the method developed in the Detroit foundry of the Ford Motor Co., a brief reference is made at this point. The crankshafts are molded in groups of four with a large sprue in the center. The mold is made up of 16 flat cores of varying thicknesses, each core containing suitable openings to form part of the castings at that particular plane. The group of cores is assembled vertically. The top core contains the pouring basin and four large riser openings, continuations of each of the crankshafts.

The coremaking unit includes a sandslinger erected at the perimeter of a turntable on which

are mounted the 16 coreboxes approximately 3 feet from the floor. The operation is continuous and the output is 200 cores per hour. Members of the coremaking group remain in fixed position inside the circle, and each man performs his allotted task as the coreboxes pass his station. Thus one man sprays the box with a thin mist of kerosene oil, another man places a small amount of sand in certain pockets and inserts small reinforcing wires, before the box passes under the stream of sand from the sandslinger. Diametrically across from this latter point the coreboxes are rolled over on a pair of machines made by the International Molding Machine Co., Chicago. The corebox is held stationary while the core on a plate drops a sufficient distance to be removed. The corebox is returned to circulation and the core is placed on a shelf in an oven in the immediate vicinity. In this high vertical type gas fired oven built by the Young Bros. Co., Detroit, the core shelves are attached to chains which carry them to the top and then down on the opposite side, where the dried cores are removed and placed on a conveyor. Each core remains in the oven 2 hours and 20 minutes before removal.

and projecting 1¼-inches above the surface of the core are coated with copper to prevent corrosion and also assure a more thorough anchorage in the casting. In the cleaning operation later, the prints or stumps are knocked off with a hammer. Just before the cores pass around the turn on the conveyor an attendant tests each core with a set of 16 gages. As the cores travel along the second leg of the conveyor, attendants remove them and place them on racks for the convenience of the assemblers in making up the complete mold.

A pendant type of conveyor, parallel to the first but considerably longer carries the molds first to the pouring station, then round a turn and through the cooling and shakeout chamber. The empty carriers then round a second turn and once more pass the assembling station. Each heat from the furnace is sufficient to pour from 22 to 25 molds and the conveyor has accommodation for 142.

General features of the conveyor are shown in the accompanying illustrations. Each unit is made up of a length of stiff 4-inch steel pipe, suspended at the top and bent in the center to bring the center of the load under the top suspension point; a plate at the bottom to support the load; a cover plate hinged at the top and four long bolts provided with wing nuts at the top.

The stack of cores, of various (*Please turn to page* 86)

Left—Aluminum coreboxes mounted on a turntable pass in constant succession under the nose of a sandslinger. Below—The ladles are preheated with gas torches

Hot plates are placed in carriers suspended from a light monorail which carries them first through a cabinet where they are sprayed with water and cooled, and then returned to the vicinity of the core roll-over machines on the turntable. As the cores travel along on the conveyor they are sprayed with silica wash and then pass under a hood where a number of gas jets dry the wash. Each of the conveyor plates is circular and is free to revolve. At the spray station the plate comes in contact with a side rail and the friction is sufficient to cause it to revolve, thus affording the sprayer opportunity to cover the vertical walls.

Immediately beyond the drying station an attendant inserts small steel chills in prints provided for the purpose in some of the cores. The chills ¾-inch in diameter

Major L. L. Anthes Is Awarded Gold Medal of A.F.A.

MAJOR LAWRENCE LEE ANTHES, president, Anthes Foundry, Ltd., Toronto and Winnipeg, president, Imperial Iron Corp. Ltd., St. Catharines, chairman, Anthes-Tait Foundry Ltd., Vancouver, B. C., president, Lennox Furnace of Canada, Ltd., past president of the A.F.A. and an industrial leader of Canada recently was voted the John A. Penton gold medal of the American Foundrymen's association by the board of directors acting on the recommendation of the board of awards in recognition of distinctive service to the foundry industry of North America. Formal presentation will be made at the annual dinner on Thursday evening of the convention week.

Each of the four gold medals of the American Foundrymen's association carries the artist's conception of a characteristic particularly essential to leadership. The John A. Penton medal represents *vision*, a characteristic certainly dominant in the career of Major Anthes. A study of his presidential address at the Cincinnati convention in 1909 reveals the extent to which his vision foresaw the progress and growth of the foundry industry, particularly with respect to the mechanization of operations and the development of continuous pouring foundries. At that time he prophesied the future possibilities for the American Foundrymen's association, and devoted considerable time during his term of office in the building of that organization. His association work has covered a considerable period of time, including practically all of the present century. He served as vice president in 1906 and 1907 and as president in 1908 and 1909. In addition, he has served on many committees and also on the board of directors of that organization.

Major Anthes was born in Toronto, Canada, Nov. 26, 1876. When 20 years of age he entered the service of the Toronto Foundry Co., joining his father in the manufacture of cast iron soil pipe and fittings. In 1899 he left that company to enter the field of journalism as a reporter on a Toronto paper. For three years he indulged in the natural bent for writing and dramatics, and because of his diversified accomlishments was able to write the play, paint his own scenery and play the lead in various light operas produced.

In 1902 he rejoined his father in the Toronto Foundry Co. Ltd., occupying the position of foundry superintendent. In 1908 that firm changed its name to Anthes Foundry, Ltd. Through the efforts of Major Anthes, the company extended its business and erected a soil pipe plant in Winnipeg in 1912. He became managing director and secretary-treasurer of the Anthes Foundry, Ltd., Toronto and Winnipeg, August, 1914, upon the death of his father.

During the war he was connected with the Canadian expeditionary forces from 1916 to 1918 with the rank of major. He was appointed director of the demobilization branch of the department of soldier's civil re-establishment in September 1918, assuming responsibility for repatriation of Canadian overseas forces. He continued in that capacity until June, 1920.

Major Anthes has taken an active interest in the industrial development of Canada. From 1926 to 1932 he was chairman, industrial relations committee, Canadian Manufacturers' association, from 1932 to 1933, vice president of that group, and from 1933 to 1934, president. He is first vice president, National Construction Council of Canada, a member of the advisory board, Canadian Construction association, vice president and chairman of the constitutional committee, Canadian Institute of Plumbing and Heating, and an alumni member of the National Founders' association.

A Glimpse at the Foundry of 1950

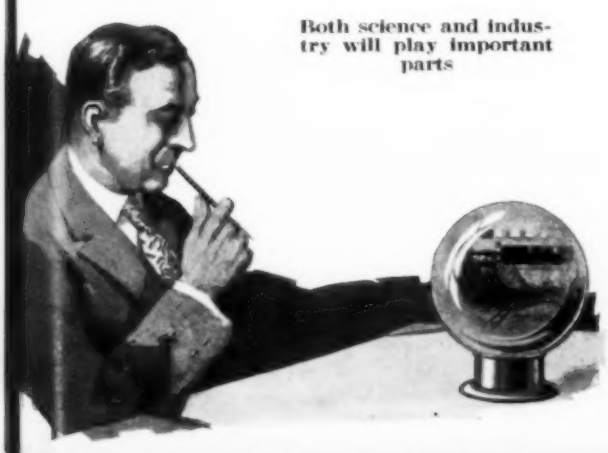
Startling innovations predicted in plant, equipment, supplies, practice and product

By FRED J. WALLS
International Nickel Co., New York

CHANGE is one of the things of which we are absolutely sure. The foundry of today will be different tomorrow. It is a simple matter for all of us to look back 15 years and comprehend the progress that has taken place in the art of founding, but we are not capable of foretelling definitely what the science of founding will be 15 years from now. At one time founding was an art imbued with mysteries and fortified by the secrets of men, molders and melters, who held back their knowledge for fear that the neighbor would become more proficient and steal the job. We have passed from the stage wherein personal experience is the only factor in success to a period of scientific control of materials and processes. However, both the practical man and technical man must realize that each contribution is of equal importance to progress, if the visionary foundry shall become an actuality.

There seems to be a natural law that regulates the advance of science: Where only accidental observations can be made the growth of knowledge creeps, but where organized laboratory experiments can be carried on knowledge leaps forward. Research today becomes the beacon of tomorrow.

With these thoughts in mind, an attempt will be made to describe a conception of the foundry in 1950. First of all it is necessary to have a location for this foundry or rather these foundries.



Both science and industry will play important parts

Transportation and availability of materials will not be the primary factors in selection of sites, as in the past, but rather labor and living conditions. These are bound to be more favorable in decentralized localities. There is plenty of non-productive soil, most of which is already plotted out and grown with weeds, and on some of that land the 1950 foundries will be built. There is no question but that in a large majority of cases it will be found most economical to construct new buildings rather than attempt to revamp existing foundries to conform to regulations which will be enacted with respect to the sanitation and health protection for labor.

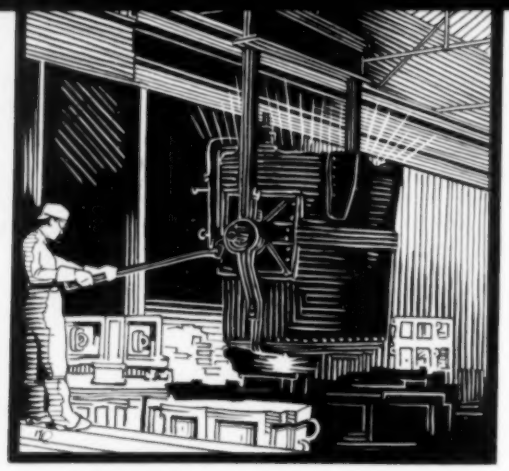
Classification of Foundries

The types of classifications of foundries probably will be grouped under 4 general headings as follows:

1. Specialty (One commodity such as piston rings)
2. General jobbing (Small quantities)
3. Production jobbing (Large quantities)
4. Corporation foundries (Complete lines)

Referring to this classification of foundries in 1950, may I justify this arrangement by citing reasons, bearing in mind, however, that there will always be in existence small jobbing foundries making castings where special properties are not required. It will be impossible for any one individual to become sufficiently posted on all the scientific problems involved in the foundry processes, thus making it necessary for employment of a group of specialists technically trained in the various sciences. This increases overhead expense, and as the watchword of 1950 will be economy, just as it is now, there must be volume over which to spread this additional cost. Thus it will be seen that the specialty foundry, where possibly one specialist can control the variables, and the larger jobbing production foundry, where several specialists are necessary and over which there is a larger volume to carry the burden, will be the foundries of 1950.

Regardless of classification, the 1950 foundry will be air conditioned. Improved metal and sand handling equip- (*Please turn to page* 90)



QUESTIONS and ANSWERS

This department includes problems relating to metallurgical, melting and molding practice encountered in making castings. Questions from subscribers addressed to the Editor of The Foundry will be answered by members of the editorial staff, supplemented where occasion requires by the advisory staff.

Several Metal Mixtures Available for Master Patterns

We are using the following mixture for master patterns in aluminum matchplate work: Lead 50 pounds; tin 50 pounds, and antimony 4 pounds. We melt the antimony first, then add the tin, followed by the lead. We have been securing good results but find this mixture expensive. Can you recommend one less expensive?

As far as we know the pattern alloy you now are using is about as cheap as any that is recommended for low shrinkage. The one usually employed is composed of 50 per cent tin, 49 per cent zinc and 1 per cent of a deoxidizing alloy composed of 90 per cent zinc and 10 per cent aluminum. That is made by melting the zinc, adding the deoxidizer after removing from the furnace and then adding the tin.

Another low shrinkage alloy is composed of 47 per cent zinc, 50 per cent tin and 3 per cent bismuth, and a third contains 58.50 per cent tin, 22 per cent zinc, 12.50 per cent lead and 7 per cent antimony.

A white metal pattern alloy that is used to a considerable extent is comprised of 80 per cent lead, 10 per cent tin and 10 per cent antimony, but we cannot vouch for its non-shrinking qualities.

Slight Change in Practice May Cause Difficulty with Metal

We have developed trouble with bronze bushings, especially those made from 88-10-2 and 85-5-5-5. We find small pit holes on the inside of the casting next to the core. Can you advise us the best core mix to use for such bushings?

This is a common complaint in the alloys listed. If you have not had such complaint with your bushings in the past, it is evident that your core work has been satisfactory.

It would seem that the trouble is with the metal itself. We suggest fracture to see if the defects are discolorations of the metal that indicate bad melting practice. The fact that they concentrate around the core does not preclude the possibility of their being caused by the metal having been gased. Obviously, in a green sand mold, the outside of the casting will cool faster than the inside, because the evaporation of the moisture in the green sand mold will chill the metal faster than where it contacts with the core. The result is that gas is released from the first metal to be cooled and travels toward the inner wall of the casting where the metal is still fluid, resulting in the pit holes described.

It may be that a change in melting practice has not been intentional; in fact, the changing of the metal conditions may be solely due to the accumulation of dirt in the air passages or flues, thereby reducing the amount of oxygen available for combustion purposes, resulting in under burnt gases, which are readily soluble in the bath. An increase in oxygen for combustion, which would result in a much increased speed of melting, suggests itself as being the cure for your trouble.

Cupola Relined To Reduce Inside Diameter of Melting Unit

We propose to reduce the size of our 51-inch cupola to 39 inches below the tuyeres and to 30 inches above the tuyeres for a distance of 5 feet. At the point the lining will flare gradually outward to merge with a 39-inch diameter lining extending to the charging door. We are wondering if the increased diameter above the 5-foot straight section will affect the normal melting speed of a cupola 30 inches inside diameter.

Your proposal to line the cupola to 39 inches below the tuyeres and to 30 inches for a height of 5 feet above the tuyeres should work out sat-

isfactorily. As a matter of fact all the melting is done in an area which extends only 2 or 3 feet above the tuyeres. Above that point the cupola merely is a storage hopper or funnel for feeding the stock into the melting zone. It may be 3 feet high and it may be 30 feet.

The ascending gases preheat the stock to a certain extent. For that reason cupola builders set the charging door at a point to correspond with the effective height of the preheating action. Approximately this height is three times the inside diameter of the cupola. However, instances are on record of charging doors 30 feet above the bottom. On the other hand small cupolas in use here and there are charged directly through the open top 5 or 6 feet above the bottom plate.

Metal Gassed During Melting Gives Defective Castings

We would appreciate advice on the proper method of making a bronze pump liner. We have trouble getting a solid casting. We melt our bronze in a rotary furnace and also have tried gas fired crucible furnaces.

The method of molding pump liners has two schools of thought. The first believes that these should be cast on end; and the other, that they should be cast horizontally. Advocates of either contend that they have never succeeded in making satisfactory castings by following the recommendation of the opposite school. In reality, either may be followed with a reasonable assurance that castings will be satisfactory if molding and coremaking are well done and the metal has been melted properly to insure an adequate supply of good metal of the alloy desired.

Molding should be done with the thought that a large area of the metal is exposed to the effects of the mold; consequently, venting must be good to prevent blows from gases developing in the mold or in the core. The surface of the mold and core should be clean and smooth and well blacked. Provision should be made for the entrance of the metal with as little disturbance as possible, with gates located at or near the bottom of the mold. The gates should be adequate to allow free flow of metal and the sprue of such proportions as to be capable of being kept full throughout the entire pouring period, so that no air is sucked in with the metal during pouring. The necessary risers should be provided to insure the proper feeding of the casting during solidification.

The description of the mealy metal in your pump liners would indicate that your trouble lies in your furnace. You evidently have produced a metal which has been highly gassed; or in other words, a large amount of under burnt gases have been absorbed by the metal during melting. Had these gases been burnt by an adequate supply of oxygen during melting, they would not have been soluble in the alloy.

The metal should be very fluid during pouring and should shrink properly in the risers after solidification. If there is not the proper amount of shrinkage in the risers, you can be sure something has gone wrong and that the casting is liable to develop unsatisfactory characteristics.

There are almost as many alloys for this purpose as there are makers. The alloy—80 per cent copper, 10 per cent tin, and 10 per cent lead commonly is used. If a harder alloy is required, the lead can be reduced and even some zinc may be added to replace the amount of lead so reduced. There are many pump liners made from the composition; 85-5-5-5 but they do not resist the wear as well as those containing a little more tin. There are a great many liners made from the alloy known as steam metal: 90 per cent copper, 6½ per cent tin, 1½ per cent lead and 2 per cent zinc. All of these alloys must be melted properly. The best possible molding can be ruined entirely by pouring a mold with metal that has been gassed.

The fact that your small liners seem to be sound when the larger ones poured from similar metal develop flaws, is no indication that the metal has not been gased. It merely means that the small liners have been of such size as to chill rapidly and the detrimental results from gassing are not so evident.

Gating Change Will Eliminate Holes

We are sending a brass casting which contains a number of holes at one end. The same defects appear in other castings where the cope is flat. Location of the spots or holes vary to a certain extent, but remain around the region indicated in this particular casting. No. 1 Albany sand containing 5½ to 6 per cent moisture is used. The metal is removed from the furnace when up to temperature and poured at 1950 to 2000 degrees Fahr. according to the pyrometer. If the temperature is much lower, it scars and those are so deep that they will not clean out. The alloys is 79½ per cent copper; 2 per cent tin; 16 per cent zinc, and 2½ per cent lead. The casting is gated at one end, and that end is raised 4 inches so the metal flows down hill.

The casting is approximately 43 inches long, and appears to be a so-called double beam used in a scale. Even though it is tilted so that the metal flows down hill, in our opinion it is too long a flow to obtain the best results. We believe that it should be gated either with sprues at both ends, or from a sprue at the center of one side with branches from a runner. We believe the small holes at the end result from occluded gases which do not have the opportunity to escape from the metal due to the fact that it is too cold by the time it reaches the extreme end of the casting.

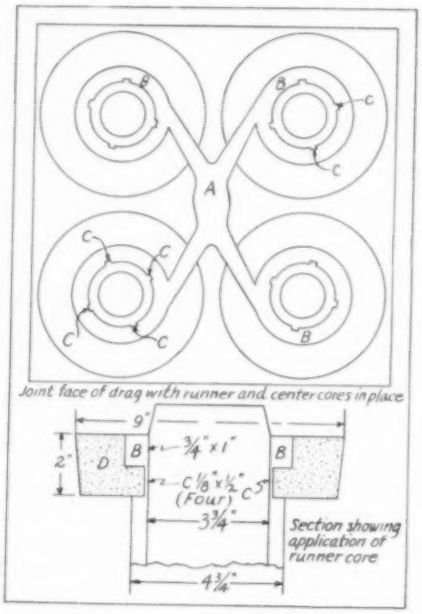
Gassy condition of the metal must be eliminated by more attention to the melting practice. See that the metal is melted as quickly as possible. For coke-fired furnaces the pits should not be too large or too deep. Up to a No. 70 crucible 3 inches of coke all around, and from 4 to 8 inches below will be about right to bring the top of the crucible about 2 inches above the bottom of the flue. Also see that the grate bars are not too close together so as to permit plenty of air to enter. Flues about 6 x 8 inches, and a stack with about twice the area of all the flues entering should be satisfactory. The stack should be at least 30 feet high, and in any event should be higher than any nearby building.

Gate Manganese Bronze Bushing on Top

We are making manganese bronze bushings 4¾ inches outside diameter, 3¾ inches inside diameter, 19 inches in length and will appreciate your advice on the best method for gating these castings.

The best method of gating bushings depends to a considerable extent on whether they are poured in a horizontal or vertical position. In this particular instance we should prefer the vertical position with four patterns in an 18-inch square flask, as shown in the accompanying illustration. A modification of the method may be applied where the castings are molded singly or in pairs. Assuming that patterns already are in existence they may be adapted to this method by attaching a flat circular core print 2 inches thick to the top end. This print is for the reception of a core containing the runner and gate passages.

Detail of the runner and gates is shown in the sectional view where *B* is the runner passage ¾ x 1 inch and *CC* are the four gates ⅛ x ½-inch.



General plan and detail of top gates for four bushings

A continuation of the runner passage at a tangent joins the branch runner formed in the green sand of the mold at the joint line as shown at *A*. Metal poured in a single central sprue feeds all four runners. The turbulence of the flow is checked in the four circular runners and the metal sinks gently through the four small gates *C*.

In many instances drossy, dirty bushings are blamed on the metal or the gates, when in reality the fault lies in the molds or the cores. Molds must be rammed hard, particularly around the bottom to prevent the metal from straining. This is turn involves the use of highly permeable sand worked as dry as possible to permit the ready escape of the large amount of steam generated in a mold of this kind. If the steam from the mold and the gas from the core cannot escape readily they—or either one—will set up a commotion in the liquid metal and the resulting casting will be permeated with blowholes and dross. As an additional precautionary measure the core should have a vent hole at least 1-inch in diameter and a vent wire should be employed to form a ring of vent holes around each pattern. Before the bottom board is clamped in place a shallow circular trench is scooped in the sand with passages from the trench leading to the outside of the flask.

Bronze Cast in Dies at Low Temperature

Can you supply us with any information on the method or equipment for casting brass and bronze in die molds at a low temperature.

You probably have reference to the method and equipment developed by Joseph Polek, Prague, Czechoslovakia, in which the metal in a molten, but not exactly fluid condition is forced into a steel mold under a pressure ranging from 3000 to 6000 pounds per square inch. The process and related features were covered in an article on die casting which was published in the Feb., 1934 issue of THE FOUNDRY.

Briefly, the process is based on the fact that metal at a temperature of approximately 1600 degrees Fahr. will not adversely affect the mold. Under the high pressure exerted, the mushy plastic material fills the mold as readily as any of synthetic nonmetallic materials which have been produced in various forms of presses in recent years. The machine is operated hydraulically and the dies are formed from what usually is known as high speed steel conforming approximately to the following analysis: Carbon 0.30-0.50 per cent; silicon 0.20-0.60 per cent; manganese 0.25-0.50; per cent; chromium 1.00-3.00 per cent; vanadium 0.20-1.00 per cent; tungsten 8.00-14.00 per cent.

As distinguished from the usual type of die casting machine in which the melting pot is an integral part of the mechanism and the metal is drawn through a gooseneck connection, the melting pot in the Polek machine is operated independently. The molten metal for each *shot* is dipped from the pot and poured into the pressure chamber of the vessel.

Phosphor Bronze As Specified by S. A. E.

Can you give us information on the composition of the Society of Automotive Engineers' nonferrous alloy No. 64?

The alloy which the S. A. E. designates as No. 64 is a phosphor bronze which contains from 78.50 to 81.50 per cent copper; 9 to 11 per cent tin; 9 to 11 per cent lead; 0.05 to 0.25 per cent phosphorus; 0.75 per cent maximum zinc, and 0.25 per cent maximum other impurities. The following minimum physical properties are indicated for the alloy: Ultimate tensile strength, 25,000 pounds per square inch; yield point, 12,000 pounds per square inch, and elongation in 2 inches, 8 per cent.

ADVERTISING PAGES REMOVED

Viewing Foundry Developments

At Short Range

A RESOURCEFUL foundryman in the Middle West recently developed a novel method for molding a cast iron gear 46 inches diameter, 5 inch face, 90 teeth, from an old casting. He blocked out a stick 36 inches in length, the shape of the space between two teeth. This stick was cut into 5 pieces approximately 7 inches in length. The pieces were nailed to a flat board and 13 molds were made, a total of 91 castings. The castings were tumbled and then rubbed with a mixture of oil and plumbago. The old gear was placed on a board and the new castings were set in place, one between each pair of teeth. The extra 2 inches on the bottom anchored them in the sand. The mold was made in the usual manner by a molder and helper working from 7:30 a.m. to 11 a.m. It was poured in the center on the hub and six 1-inch risers were placed on the rim. The casting was perfect with clean, smooth teeth.

♦ ♦ ♦

A Michigan foundry has developed an alloy steel piston which features an exceptionally light section. This piston now is undergoing tests with several automobile manufacturers.

♦ ♦ ♦

Ratio of silicon to nickel steel in their respective abilities to graphitize has been found to be between 2 and 3 to 1. In other words, for every unit of silicon removed in the interest of densifying, it is necessary to add from 2 to 3 units of nickel.

♦ ♦ ♦

National Malleable & Steel Castings Co., Cleveland, has a ventilating system for its office building in which air from the outside is washed, and its temperature and humidity regulated before it is carried to various parts of the building. No air is recirculated from the building itself.

♦ ♦ ♦

Aluminum castings to be arc welded should be prepared for welding by grinding, filing or scraping clean an area 1-inch wide completely surrounding the part to be welded. On large areas the casting should be heated just above the temperature at which the hand may be held on the metal without discomfort.

♦ ♦ ♦

Research department of the American Smelting & Refining Co. has developed a cadmium-based alloy hardened with nickel and marketed under the name of *Asarcoloy* No. 7. The material is used for bearings, and is claimed to have a lower co-efficient of friction than babbitt and also shows less tendency to cause sludging of lubricating oil.

♦ ♦ ♦

POURING temperature should be correct if the best results are desired, and in that connection a leading English metallurgist states that the pouring temperature of phosphor bronze containing 88 per cent copper, 12 per cent tin, is correct if the surface of the riser basin solidifies within 15 seconds after filling.

♦ ♦ ♦

Chrysler Corp., Detroit, is reported experimenting with an all-aluminum engine, not even cylinder liners being used. The block is so light one man can lift it. While there does not seem to be an immediate prospect of an all-aluminum engine going into commercial production, nevertheless the trend of thinking of automotive engineers is indicated.

♦ ♦ ♦

A recent patent describes a method for casting steel chain centrifugally. The links are formed in dry sand cores which are located at the outside of a motor driven turntable. Just inside the link cores is located the metal channel with short gates to each link cavity, and the metal channel in turn is connected by radial gates or arms to a central pouring basin. Claims are made that the chains obtained are solid and dense. By the process individual links, shots of chain using precast links alternately, or shots of chain without use of precast links may be produced.

♦ ♦ ♦

OLD work patterns are being altered by welding to form new designs. In one case an improvement in design of an ordinary cast iron bell and spigot pipe made it desirable for the company to change over completely to the new type. Because of the wide variety of sizes and types, such a change would have been exceptionally expensive. Because the hub and spigot for the Y-connection is the same as for a T or X-connection, all that was necessary for the foundry to do was to make a new master pattern for each size hub and spigot and then cast enough work patterns from these to correct all the old foundry patterns. Using an oxy-acetylene cutting blowpipe, the hubs and spigots from the old pattern were cut, and new ones bronze-welded in place. Patterns then were machined to a finished line.

♦ ♦ ♦

Ford is reported using an alloy cast iron for drawing dies on many parts. The alloy is as follows: Carbon 3.25 per cent, silicon 1.25 per cent, manganese 0.45 per cent, nickel 2 per cent, and chromium 0.70 per cent. These dies are heated to 1500 degrees Fahr., quenched in oil, reheated to 900 degrees Fahr. and cooled in air. This is said to give a hardness of 286-321 brinell. Where dies are too large to be heat treated, the mixture is changed to the following: Total carbon 3 per cent, silicon 1.45 per cent, manganese 0.90 per cent, nickel 3.00 per cent and chromium 0.90 per cent. Castings allowed to cool completely in the mold give a brinell hardness of 280-300.

David Hill

R. E. Kucher

C. B. Magrath

Men of Industry

Whose Activities Are Making Foundry History

G. W. Merrefield recently has been made general superintendent of the Alhambra, Calif., plant of the Kay Brunner Steel Products Co. Foundry activities of that company, previously conducted at Los Angeles and Alhambra, now will be concentrated at the latter plant.

Mr. Merrefield received his foundry training as a special apprentice at the Indiana Harbor Works of the American Steel Foundries, and has been connected with the foundry industry for over 20 years. During that time, he was general manager of the West Michigan Steel Foundry, Muskegon, Mich., and manager of the foundry department of the Clark Equipment Co., Buchanan, Mich., Pettibone-Mulliken Co., Chicago, and Lorain Steel Co., Johnstown, Pa.

L. Douglas Smith has been elected president of the Lewis Foundry & Machine Co., Coraopolis, Pa., succeeding Jan R. Dunsford.

Alexander Taylor, assistant to the vice president of Westinghouse Electric & Mfg. Co., East Pittsburgh, has retired after 47 years' service. His first executive position was as superintendent of the company's Allegheny foundry, following which he was made works manager at East Pittsburgh in 1905, a post which he occupied for 15 years. In 1920, he was appointed assistant to the vice president.

James T. Sutliff, for a number of years connected with the Roots-Connersville Blower Corp., Connersville, Ind., now is associated with the Chicago office of the organization, 20 North Wacker drive.

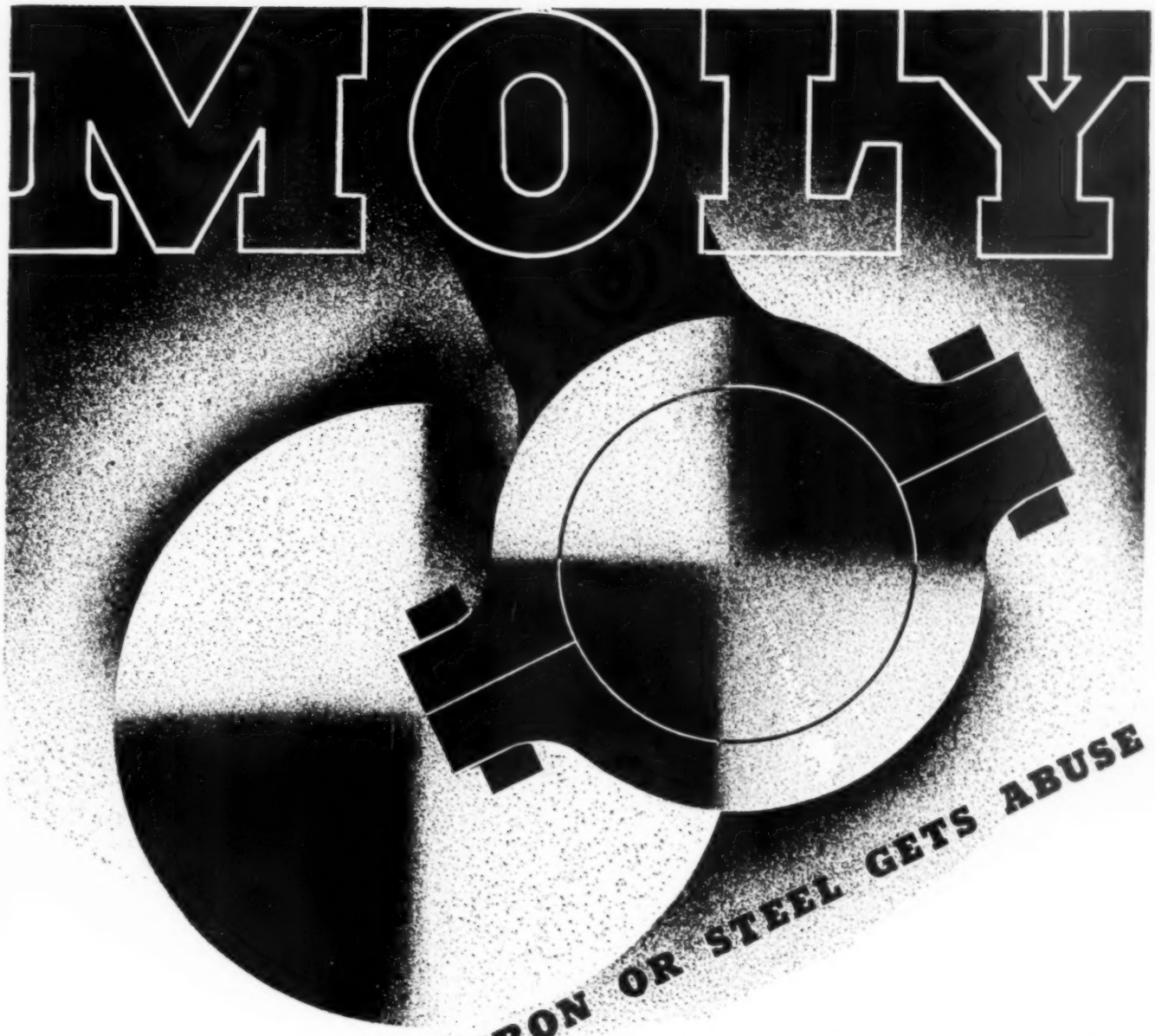
Edward H. Muehlenbrock recently was re-elected president of the Holland Furnace Co., Holland, Mich. Other officers are as follows: P. T. Cheff, vice president and general manager; George B. Tinholt, treasurer; and A. W. Tahaney, secretary.

L. A. Prescott recently was made vice president in charge of the engineering division, Blaw-Knox Co., Blawnox, Pa. Mr. Prescott is a graduate of Michigan State college, East Lansing, Mich., and has been connected with the Blaw-Knox Co. since 1917.

David Hill, foundry and power transmission engineer, has joined the staff of Beardsley & Piper Co., Chicago, as service and development engineer. Mr. Hill has spent over 20 years in the foundry equipment industry, during which time he has been associated with the Ford Motor Co., the American Radiator Co., and the Palmer-Bee Co. His work has covered the design, manufacture, installation and sale of a wide variety of foundry equipment.

Charles W. Schaberg now is general foreman, Lebanon Steel Foundry, Lebanon, Pa. For 16 years Mr. Schaberg was superintendent of the S. Morgan Smith Co., York, Pa., and for 2½ years superintendent of the York Foundry & Machine Co., York, Pa.

Ronald E. Kucher, recently elected vice president of the Gray Iron Founders' society, is manager, Olympic Foundry Co., Seattle, Wash. Mr. Kucher was born in Everett, Wash. in 1896, and entered the foundry business with his father, Charles W. Kucher in the Olympic Foundry Co. in 1912. He was connected with the Olympic Steel Works from 1914 to 1916, and has been with the Olympic Foundry Co. from 1916 until the present time. He is a past president of the Washington Foundrymen's association, and a director of the Gray Iron Founders' society from dis-



TORSION — like the relentless twisting of a heavily loaded crankshaft. IMPACT — like the incessant battering of a trip-hammer or pile-driver. HEAT — like the torturing temperatures encountered by boiler tubes and cylinder walls. . . . There are many types of steel, both alloyed and unalloyed, which will meet certain specified physical requisites for normal resistances to these enemies of metallurgy. But what happens to such steels when they are subjected to overloads? Often they fail — and usually their failure is dismissed with the conclusion that "nothing can be done about it." But something *can* be done to enable both iron and steel to withstand heavier abuses. And the most outstanding element in the recent development of this much-desired added quality is "Moly"— the alloy which not only improves ordinary iron and steel but which actually enables other alloys to do *their* particular work better.

Interesting details about the properties of Moly irons and steels will be found in these two books which may be had for the asking: "*Molybdenum in* 1934" and "*Molybdenum in Cast Iron* — 1934 *Supplement*" . . . while current progress and specific examples of Moly applications may be followed through our periodical news-sheet "*The Moly Matrix*." A post-card request puts you on our mailing list. And — if you've some particular alloy problem you'd like to have us help you solve, our metallurgists and Detroit experimental laboratory are at your command. Climax Molybdenum Company, 500 Fifth Avenue, New York. (In Canada: Railway & Power Engineering Corp., Ltd.)

CLIMAX Mo-lyb-den-um

trict 1A which includes Oregon, Washington, Idaho and Montana.

P. E. PETERSON, has been an instructor in the department of foundry practice, Wentworth institute, Boston, for many years. He attended Minneapolis public schools and learned the molder trade in that city. He was appointed instructor in foundry practice at the University of Minnesota in 1906, and held that position until 1915 when he became affiliated with the foundry department at Wentworth in-

P. E. Peterson

stitute, as assistant instructor and later as instructor.

ROBERT C. STANLEY, president, International Nickel Co. of Canada Ltd. was awarded the honorary degree of doctor of engineering by Stevens Institute of Technology, New York, on June 9. Mr. Stanley is an alumnus, having graduated in 1899 with a degree in mechanical engineering. In 1933 he was elected to serve as a member of the board of trustees.

P. J. POTTER, formerly second vice president, Pangborn Corp., Hagerstown, Md., recently was elected a director and vice president of the company. Mr. Potter, who will be directly responsible for engineering, sales and production, has been associated with the Pangborn organization for 20 years, having joined that company in 1915 as sales representative for the middle west and Pacific coast territory. In 1922 he retured to Hagerstown to become works manager of the foundry and manufacturing plants. In 1931 he was elected second vice president.

VICTOR F. STINE recently was elected second vice president and sales manager of the Pangborn Corp. Mr. Stine has been connected with that organization for 23 years during which time he has had charge in turn of the order, accounting, purchasing and sales departments.

JAMES J. ZIMMERMAN recently was made works manager, Osborn Machine Co., Du Bois, Pa. Mr. Zimmerman formerly was connected with the Bituminous Coal code in Altoona, Pa., in the capacity of a special statistician. Prior to that, he was production manager for the Elliott Co., Jeanette, Pa. for approximately ten years, general superintendent, Scott Foundry department, Reading Iron Co., Reading, Pa., and previous to that held various positions from machinist to engineer with the Cambria Steel Co.

J. M. FACKLER now is in charge of the foundry of the Kennett Foundry & Machine Co., Kennett Square, Pa. Mr. Fackler began his foundry career with the Middletown Car Works, Middletown, Pa., where he was employed for 15 years, the last 2 years as foreman. After the plant was closed in 1910, he worked for several years in the molding department of the Baldwin Locomotive Works, Philadelphia, and then was made foreman of the Domestic Engine & Pump Co. foundry, Shippensburg, Pa. In 1912 he was placed in charge of the Sharples Separator Co., West Chester, Pa., and during the last 7 years he has been connected with the New Holland Machine Co., New Holland, Pa.

C. B. MAGRATH, president, North Western Foundry Co. and Greenlee Foundry Co., Chicago, recently was elected president of the Gray Iron Foundries' society. Mr. Magrath was born in Lethbridge, Alberta, Canada, in 1889. Following his elementary education he was graduated from McGill university, Montreal, in 1910 with a degree of bachelor of science. In 1911 Mr. Magrath was graduated from Massachusetts Institute of Technology, Boston, with the degree of master of science. He was employed for a short time in the foundry department of the International Harvester Co. in Chicago, then removing to Lethbridge where he operated the Lethbridge Iron Works Ltd. until the outbreak of the European war. He served overseas 3½ years with the Canadian Expeditionary Force in the artillery service, returning to Chicago in 1919 at the close of the war. He was employed as an engineer for the Consumers Co., Chicago, until 1924 when he was elected president of the North Western and Greenlee Foundry companies, a position which he now occupies. During the past year he served as vice president of the Gray Iron Founders' society.

BRINTON WELSER, vice president, Chain Belt Co., Milwaukee, who recently was elected president and chairman of the Malleable Founders' society, was born July 20, 1891. Immediately after he was graduated from the University of Wisconsin, college of mechanical engineering, he entered the employment of the firm with which he is at present connected. He was elected secretary in

Brinton Welser

1924 and was made director and vice president in 1930.

J. E. HURST, (see page 40) recently elected president of the Institute of British Foundrymen, is technical director, Sheepbridge Stokes Centrifugal Castings Co. Ltd. and also of the Bradley & Foster Ltd., Darlaston, England. Mr. Hurst has been associated in the development of the centrifugal casting process in Great Britain, particularly in its application to special cast irons for high-duty purposes, and was manager of the centrifugal casting department of the Newton Chambers & Co. Ltd., which now has been merged into the organization with which he is connected.

Mr. Hurst formerly was assistant chemist to Beyer, Peacock & Co. Ltd., Gorton, Manchester. He became successively chief chemist and metallurgist to Richard Hornsby & Sons Ltd., Grantham and Stockport, and chief chemist and metallurgist to D. Napier & Sons Ltd., Acton, London. Later he was connected with the centrifugal casting process with Stokes Castings Ltd., Mansfield, and Centrifugal Castings Ltd., Kilmarnock.

He is the author of several well

(*Concluded on page* 65)

Announcing the
SCHNEIBLE MULTI-WASH WET COLLECTOR *for* SUPPRESSING DUST

—in general atmosphere
—at the SHAKE-OUT
—at the TUMBLING MILL
—at the SAND BLAST
—at the SAND PREPARATION PLANT

Now operating at

INTERNATIONAL HARVESTER CO. ..... (*Five Units*)
KELSEY-HAYES WHEEL CO. ..... (*Four Units*)
CHEVROLET GRAY IRON FOUNDRY CO. ..... (*One Unit*)
DODGE-CHRYSLER CORPORATION ..... (*One Unit*)

and others in course of construction and installation.

Schneible Multi-Wash Dust Collectors are proved by over fifty installations and seven years of satisfactory operation. They feature the wet impingement of dust—the dewatering of sludge—and the prevention of freezing in cold weather. They are highly efficient — have a constant back pressure — have no moving or rapidly wearing parts — require a minimum of maintenance—and are available in sizes to cope with every dust suppression problem.

Eliminate your dust hazard—investigate the Schneible Method of dust suppression.

CLAUDE B. SCHNEIBLE

4755 N. Crawford Ave. Chicago, Ill.

Influence of Temperature Gradients In Producing Steel Castings

By GEORGE BATTY

Part II

TEMPERATURE gradients in mold and metal which may be created by top pouring are more favorable than those attainable by bottom gating unmanipulated molds, but are not as favorable as those achieved by bottom gating and reversing the mold after pouring is completed. A fine example of good gating method is provided in Hatfield's paper — *Transactions*, A.F.A., 1934. The heading of the casting also is interesting as it shows an appreciation of the necessity for a large volume of feed metal when blind risers are used which are not served directly by ingates. Filling such risers produces in them—as it does in ordinary open heads which are not filled from the top—an adverse temperature gradient in both mold and metal. Therefore, it is necessary to have risers of such dimensions, in relation to the sections with which they are connected, that their reserve of temperature is adequate to maintain fluidity of interior metal over a period of time sufficient to ensure solidification of the casting; or, at least, of that part which each riser is devised to feed.

Gradients Are Adverse

Temperature gradients in a bottom gated casting are bound to be adverse, and only a locally favorable condition can be created by top-filling the feed heads. Reverting to the part of a casting shown on Fig. 4 and including the feed head, a temperature gradient of the type postulated in Fig. 10 would probably be produced a short time after pouring was completed. Local favorable temperature gradient within the feed head will ensure that the casting proper immediately below the riser will appear sound when the head is removed, but the adverse nature of the temperature gradient for the lower three-quarters of the height of the casting—amplified by the adverse temperature gradient of the mold, resultant upon bottom-gating — points to the conclusion that the casting cannot be expected to be free from midsection unsoundness in the lower levels. Thus it must be realized that design is a factor of great importance and that for castings produced in unmanipulatable molds — molds that cannot be reversed after pouring — the taper or wedge type of section, small end down, should merit attention of designers as being complementary to the production of integrally sound cast structures.

In castings which are of a size that can be produced in manipulated molds — using one of the reversal systems — there does not exist to the same extent the necessity for tapering wall sections, the creation of favorable temperature gradients in both mold and metal being competent to overcome, to some considerable extent, the normal difficulty of feeding a section. There is, however, very definitely a limit to what can be done by mold manipulation, this limit being prescribed by practicable pouring temperature and pouring rate.

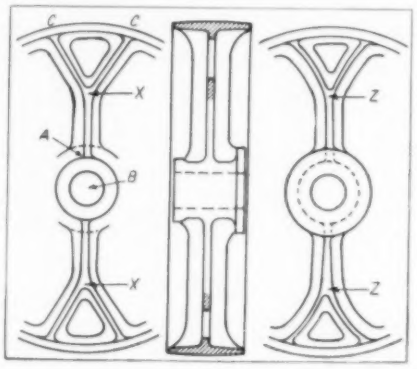


Fig. 9—(A) Design of truck wheel previously popular. (B) Modification of spoke design to overcome trouble

One of the features of promoting controlled directional solidification, as the result of properly organized temperature gradients, which appeals to the steel founder is the economy of feed metal. It is admitted that the discovery of the extent to which this economy could be carried was accidental — but for the accident, unnecessarily large feed heads might have been continued in use — and that the early applications of mold reversal were successful attempts to cure defects which were apparent in certain castings immediately the risers were removed. The temperature gradient theory, built upon the practical results arrived at by manipulating the molds after pouring is completed, is applicable with beneficial results to castings made in molds that cannot be so handled as it leads the practical foundryman to a more correct appreciation of the functions of gates and heads.

Step Gates Efficient

A system of step-gating may be considered as being of less efficiency than mold reversal, but more efficient than bottom gating, in promoting soundness of cast structure.

The concept of perfect progressive solidification, from bottom to top in orderly continuity, is one that must be discarded because of its utter impracticability; but controlled directional solidification is, for certain types of castings, an implement available to the founder. The means described — *Transactions*, A.F.A., 1934 — for achieving the desirable condition by reversing molds or by a good system of gating and heading must be amplified by chilling isolated masses, pads, or bosses that cannot be reached conveniently by feed metal. For reasons which are apparent to most practical steel foundrymen the writer disapproves the use of internal chills — variously described also as residual, cast in, remnant — in locations which effectually can be treated by external chills. It is conceded that in certain occasional instances an internal chill will achieve the desired result.

In promoting controlled directional solidification external chills can be made to function efficiently upon parts that never could be dealt with adequately by internal chills, and this without the dangers of blows and the inhomogeneities resultant upon the use of cast in denseners. The designing, as to shape and weight, of external chills in relation to the parts upon which they are

(*Continued on page* 60)

BRACKELSBERG
Rotating Furnace

Two 8-ton Brackelsberg Rotary Furnaces on assembly floor (for shipment to a large malleable foundry)

A Flexible Low-Cost Melter

The Brackelsberg is a very flexible melting unit. It may be operated at short notice, either for a single heat or a succession of heats, on regular gray iron, high-test iron, special alloys, or malleable. The melting capacity of Brackelsberg furnaces already in use or under erection, in America, is now 50,000 tons per year.

Operations may be completely timed to fit the production cycle, on either large or small volume. Thus the fullest possible use is made of a given floor space and flask equipment and molders can be kept working continuously.

• ***High Quality at Low Cost*** And all of these advantages of flexibility and high quality metal are obtained without a premium. The operating cost is surprisingly low and compares very favorably with other methods. Power consumption, including the cost of running the coal pulverizer, is less than 15c per ton. Other factors of economy are the use of low-priced fuel, ability to use a much larger percentage of scrap in the charge, reduced oxidation losses (2% or under), low refractory cost and fewer defective castings.

• ***New Bulletin Now Ready*** A new bulletin, No. 197, has just come from the press. A copy is yours for the asking. Have you considered the possibilities of this furnace on your work? Let us show you how it will save you money.

We also Build—
Electric Traveling Cranes—Cupolas—Cupola Chargers—Air Furnaces—Steel Converters—Ladles—Quick-Anneal Ovens—Tumbling Mills—Dust Filters—Stokers for Core Oven Firing—Pulverized Coal Equipment.

WHITING CORPORATION
15607 Lathrop Ave. + Harvey, Ill.

WHITING

THIS IS OUR FIFTY-FIRST YEAR

(*Continued from page* 58)

imposed is an infant art but is one which will be developed to the benefit of both castings and founders. The shape of the chill must be such that it will not promote a sharp line of chill effect. It should take care of that excess of cast metal which is imposed on the general structure as a boss on pad without interfering with the whole projected scheme of solidification. If the chill is excessive in its effect it may tend to negative other means taken to ensure an ordered and progressive solidification by closing the avenue through which feed metal should reach other parts of the casting.

Estimate Chill Weight

Weight of external chill must be related to the amount of heat it may have to take up from metal in transit as well as to the amount of heat it is devised to take from the metal at rest when the mold is full. It seems probable that the designing of efficient external chills will be arrived at empirically and will be an art for some considerable time before sufficient fundamental knowledge is amassed to warrant precise scientific definition.

While chilling may be used to mitigate the dangers attendant upon concentrations of metal which cannot be fed from risers, the fact remains that the designer can, if willing, do much to eliminate the necessity for such costly foundry expedients. Heuvers—*Stahl und Eisen*, No. 35, 1929—has suggested variations from orthodox practice in design which make a distinct appeal to the steel founder, but it must be remembered that some inescapable features of design tend to create hot spots, which, in turn, tend to promote either internal cavities or externally visible tears, or both.

The founder rightly insists upon radiused junctions where two sections of metal otherwise would produce sharp corners or angles of sand projecting into the metal. The imposition of the fillet produces a local concentration of metal that must either be fed or chilled to ensure complete soundness. Internal hot tears or enclosed pipe are evidence that humps have occurred in the temperature gradient — if it was generally of a favorable type— or that the temperature gradient was generally of an unfavorable nature.

Hot spots are most likely to form at the ingate. Simple modifications of gate design appear, superficially, to cure the trouble but it must be said that in many cases the cure is more apparent than real. The casting merely appears to be sound on the surface when the gate is removed, yet there may be a midsection unsoundness. Such a localized deficiency may be a commercial defect in certain types of castings while in others it is a metallurgical defect of no serious commercial significance.

On many types of castings poured in the orthdox way, it is easy to locate the hot spot outside the casting by gating into a main riser. Valve bodies and flanged fittings have a pronounced tendency to exhibit leaks either at the radiused junction of flange and body or at a bolthole when gated at the edge of a flange. This bespeaks, of course, a crack or tear which extends to the bore of the casting. Such a tear or crack is due to a gate hot spot and the trouble can be cured readily by gating into the base of a lumped riser — sometimes called a face riser or elbow head — on the face of the flange. Such a riser should be at least twice as thick as the flange upon which it is imposed so that the center of the mass — the last to solidify — is outside the casting. This procedure may necessitate longer coreprints than are normally provided, but the small expense of alteration to pattern and corebox is generally a good investment.

Tendency of box-like cast structures to tear at the corners is well known and this tendency persists even though the metal section is uniform, the external contour paralleling the internal radius. In such an example is demonstrated the effect of disproportion of metal to sand. The corner or angle of sand, even though apparently suitably radiused, is heated on two sides; it is subject to nearly twice the thermal attack that is imposed on the sand forming plain faces and it cannot take heat from the metal at the same rate as does the sand in contact with plain plates of metal.

Potential Hot Spots

Every so-called internal angle is, therefore, potentially a hot spot. These local humps in the general temperature gradient generally may be avoided by face-nailing the fillets, but a nice discrimination is necessary in prescribing the amount of such chilling. By face nailing is meant the use of short, flat headed nails inserted until the heads are flush with the mold face. The heads do not project into the casting to become, thereby, internal chills. Application of that simple remedy is not always practicable because of pattern construction.

Thus far, the author has treated the subject in relation to the influence of gating and heading methods, together with mold-manipulation, in promoting soundness in the cast structure which, in other words, is freedom from external tears and internal shrinkage cavities. It appears desirable to emphasize the effect of the mold — which is affected by metal in transit — upon the progress of solidification of the casting because the literature pertaining to

(*Continued on page* 62)

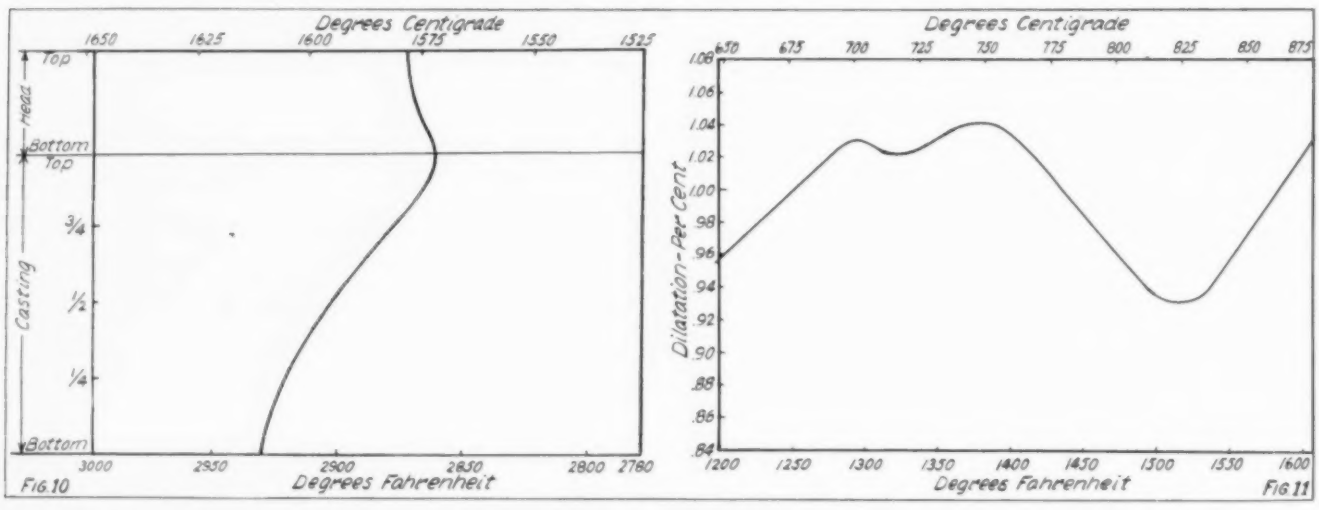


Fig. 10—Temperature gradient of casting shown in Fig. 4, and including feeding head. Fig. 11—Dilation curve, typical of the steel from which castings shown in Fig. 9 were produced

FOR INTERNAL GRINDING STERLING *offers* REAL PRODUCTION WHEELS

Due to the ever increasing demand for STERLING internal grinding wheels, we have found it necessary to increase our facilities in this department.

This surely is proof that STERLING internal wheels are very much in demand for their cutting, grinding and polishing qualities. You will be pleased with their action and long life.

THE STERLING GRINDING WHEEL COMPANY

Abrasives Division of The Cleveland Quarries Co.

Factory and Office: TIFFIN, OHIO CHICAGO: 133 N. Wacker Drive DETROIT: 101-107 W. Warren Ave.

STERLING ABRASIVES

(*Continued from page* 60)

the production of steel castings has, hitherto, hardly touched upon the matter.

The extent of this effect is demonstrated by castings produced on one of the reversal methods where, by mold manipulation, the temperature gradients of both mold and metal are disposed in the correct direction.

At temperatures above the liquidus steel is believed to behave as a true liquid and McCance—*Foundry Trade Journal*, Dec. 27, 1928—gives the figure 0.00039 contraction per degree Cent. It therefore follows that if what are ultimately to become the upper levels of the mold can be heated considerably by the relatively slow pouring of hot metal at a rate which, while sufficient to ensure a cleanly run casting, considerably cools an appreciable amount of the metal, the mold is made to conserve heat in a graduated manner and control, directionally, the solidification of the casting.

Such conservation of temperature, particularly in the heads of totally reversed castings, will, despite the high temperature of the upper levels of metal, result in adequate feeding from a relatively small reservoir or feed head. Cases have been noted where risers delivered as much as 35 per cent of their volume to the casting, this being approximately equal to 3.5 per cent of the volume of the total metal in mold. This figure of 3.5 per cent is somewhat higher than the average contraction, measurable as pipe, in castings examined by the writer. To state the matter in another way, certain castings have been produced, ranging in weight from 200 to 1000 pounds, with a discard of only 6.5 per cent. Admittedly these castings were made on the total reversal method and every precaution was taken to promote conditions that would give a high yield, yet it may be said that castings of a similar type and larger in size were made consistently on the partial reversal method with an average yield of over 85 per cent of metal in mold.

Cause of Cold Cracks

The temperature gradients in castings at temperatures below solidification point must be a study separate from the matters discussed in the foregoing part of this article. Cold cracking is probably more to be associated with design than with molding and pouring procedure. This statement is made because some designs have been noted which consistently developed such stresses in the castings as to lead to a considerable proportion of loss by cold cracking, but only small losses by hot tearing.

Fig. 9-A indicates the design of a truck wheel which was common a number of years ago, in the era of the solid rubber tire. Fig. 9-B shows the modification of spoke design which overcame the trouble of cold cracking of the spokes. It should be noted that the only modification was the alteration of the shape of the spokes, the hub and rim remaining the same in both designs. The spokes, six in number, are of cruciform section, Y type, and split to give twelve junctures with the rim and mid-web. In the straight Y type, Fig. 9-A, these junctures were equally spaced. In the curved Y type, Fig. 9-B, the distance across the top of the Y was slightly greater than the distance between the tips of two Y's.

The wheels were gated at the hub, thus ensuring that the casting was gated into its heaviest section, and also that distortion was reduced to a minimum by providing that the metal at any two or more parts of the casting equidistant from the center be of the same temperature, or as nearly so as possible, at the moment the mold is filled. This provision seems necessary on such castings as truck wheels which are of light general section and which must be as nearly as possible in balance after machining. It is not so important on heavier castings such as gear blanks.

The chief trouble experienced in the production of the wheels having the straight Y type spokes was a pronounced tendency to cold cracking either at the points marked *X* or at *A*, Fig. 9-A. Relatively few of the castings failed by reason of hot tears at these locations and the magnitude of the residual stresses obviously varied in different castings. Some would cold-crack during cleaning operations and the practice of heat treating — a straight normalizing— before fettling did not eliminate the trouble entirely. As a matter of fact, a number of fully machined castings were known to develop the characteristic crack in transit, by rail, from foundry to customer.

It is believed, by the author, that the tendency to crack was increased by machining, the removal of metal from the face of the tread and from the bore adversely affecting the residual stresses which, previous to machining, were not so remote from equilibrium as to promote a crack.

A scrutiny of the defective castings showed that in an overwhelming majority of the examples, a crack occurred at or near a point of metal concentration. Any deviation from the practice of gating at the hub aggravated the trouble and introduced other deficiencies.

Visualizing the temperature gradients — in this case, horizontally from hub to rim — it is apparent that at the moment the mold is filled the hub consists of the hottest metal contained in the hottest part of the mold. As the distance from hub increases, the temperature of both metal and mold decreases. While this is satisfactory from the viewpoint of securing adequate feeding from a riser imposed on the top of the hub it has certain adverse implications when the design is studied in relation to dilatation phenomena. A dilatation curve, typical of the steel in which these castings were produced, is shown on Fig. 11.

Remembering that pronounced temperature gradients, correctly disposed for feeding, exist in both metal and mold, and that the metal temperature at the hub is probably at least 120 degrees Fahr. higher than at the rim, solidification and subsequent cooling proceeds selectively from rim to hub. The rim, being in contact with cool mold, cools down relatively rapidly and, down to 1544 degrees Fahr. is constricting. In the early, and most rapid, part of this period the hub and the inner ends of the spokes conceivably are so hot as to respond readily to the stress without incurring any pronounced residual influence. At a later stage in the cooling of the casting the rim will be passing through the range 1544 to 1256 degrees Fahr. and will be expanding while the inner parts of the casting — hub and parts of the spokes — are constricting and contracting. It was in this thermal period that the few cases of hot tears at A, Fig. 9, were believed to be generated.

Rim Cools First

The significant points to be considered, in relation to design, are marked *X-X* on Fig. 9-A All the way down to shop temperature the rim precedes the remainder of the casting in cooling, and in aggregation of strength down to the lower end of the blue-brittleness range. The points X. X.—and similar locations diametrically opposed on the other spoke—become practically fixed points in their relation to the rim at *C-C* while the distance between them should decrease with falling temperature.

Thus, in the later stages of the cooling of the casting, the spokes were placed pronouncedly in tension of such magnitude as to lead to cold cracking in far too many instances.

It became apparent that the prime necessity was to permit the points *X*-X to move closer together in as full accord as possible with the normal uninterrupted contraction of cast steel. Accordingly the design was modified to produce what is shown on Fig 9-B. The head of the *Y*, Fig. 9-B, is produced as two curved members, each of which is of lighter section than the single member of the *Y*.

Given the same temperature gradi-

(*Concluded on page* 65)

ADVERTISING PAGES REMOVED

ents as the casting of the straight *Y* type, the points *Z-Z* could get closer together the curved spoke-members deforming under the tension of the contracting inner parts of the casting. To avoid any misconception, it should be stated that the curved spoke-members were of the same cross-section as those of the relative parts of the straight *Y* spokes. The ability of the curved upper members to straighten—that is, to assume a larger radius—entirely eliminated the cold-cracking trouble as well as the more rare occurrence of hot-tearing at the junction of a spoke with the hub.

This is the only example of design modification that the author proposes to submit in relation to the prevention of cold cracking. Others could be cited and it is believed that most practical foundrymen could, from the wealth of their experience, quote instances of difficulties encountered. It is hardly possible to entertain the hope that all such difficulties could be overcome in a manner so simple as that which effected the cure in the case of the truck wheel.

No attempt will be made by the author to summarize as it is his opinion that the matter is too complex—despite the simple examples chosen for discussion—to admit of comprehensive accuracy. It is to be remembered that each casting presents its own peculiar problem and, while castings may be classified in types, seemingly small variations affect materially the classification.

Men of Industry

(*Concluded from page* 56)

known books including *Melting Iron in the Cupola* and *Metallurgy of Cast Iron*. He has made numerous contributions to technical societies, and is the author of a paper to be presented at the coming convention of the American Foundrymen's association in Toronto.

H. WINTERTON, (see page 40) recently made senior vice president, Institute of British Foundrymen, is chairman and managing director of William Cumming & Co. Ltd., manufacturers of facings and foundry supplies, Kelvinale Mills, Maryhill, Glasgow. Mr. Winterton has been associated with that firm for nearly 30 years and on various occasions has represented the company in America.

He was proposed a member of the Institute of British Foundrymen in 1905 and was elected at the next general meeting. He then was living in the Birmingham area and for some time was on the council of that branch. He went to Glasgow in 1919 and was appointed assistant managing director and vice chairman of the company with which he now is associated, succeeding the late William Cumming in 1923. He was elected to the council of the Scottish branch several years ago and in 1929 was chosen president of the branch. He is one of the founder-members and past president of the Foundry Trades' Equipment & Supplies Association Ltd.

B. W. BIGG, (see page 40) recently made junior vice president, Institute of British Foundrymen, is assistant managing director and vice chairman, Qualcast Ltd. Mr. Bigg served his apprenticeship with Brown & Green Ltd., Luton, and obtained experience in various light casting foundries, later joining the Derwent Foundry Co. Ltd., Derby, England. He was placed in charge of the pattern department and later became successively foundry manager, works manager and works director. When in 1928 the Derwent Foundry Co. Ltd. was reorganized and became Qualcast Ltd., he was appointed assistant managing director and vice chairman. Mr. Bigg's membership in the Institute of British Foundrymen dates from 1915 when he joined the East Midland Branch of which he was president in 1932 . In addition to his work on several committees, he has been a member of the General Council since 1930.

VINCENT DELPORT, (see page 41) recently elected a member of the council, Institute of British Foundrymen, from the London branch, is European manager of THE FOUNDRY. Mr. Delport was born in London, England in 1888 and was educated in France. During the War he served in the artillery with the French army and was awarded the Croix de Guerre. Late in 1917 he was sent to the United States with the Tardieu mission to train American troops and also after the Armistice, was attached to the French high commission in New York.

Demobilized, he served with the United States Steel Products Co. in New York and Paris offices and then was engaged as a consulting engineer and a manufacturers' agent in Paris. In 1922 he was appointed French correspondent of the Penton Publishing Co., publishers of THE FOUNDRY, and in 1924 he became manager of the Penton Publishing Co. Ltd., London, a subsidiary company.

Mr. Delport is a member and European representative of the American Foundrymen's association's International Relations committee. He also is a member of the Association Technique de Fonderie de Paris, British Iron and Steel Institute, International Committee of Foundry associations and the Societe des Ingenieurs Civils de France.

Steel Works Directory

Directory of iron and steel works in the United States and Canada, twenty-second edition, recently has been issued by the American Iron and Steel institute. The cost of this book is $8.00 for members and $10.00 to nonmembers.

Obtain New Sand Freight Rates

Following a 5-year fight, led by some of the larger producers of foundry sand, railroads inaugurated July 1 materially reduced freight rates on industrial sands. For a long tome there had been a heavy excess charge on the shipment of these sands, as compared with construction sands, a premium that producers and users of foundry sands had felt was unwarranted.

A decision finally was handed down last October by the interstate commerce commission approving lower freight rates on industrial sands in official classification territory, the new rates to become effective July 1, 1935.

Foundries getting their sands from eastern points appear to be particularly favored by the decision, it is pointed out—those getting sands from such points as the Albany molding sand district, the Providence core sand district and the North and South sand shipping sections of New Jersey. Rates on shipments from some of these points are reduced more than one third. While the new rates for industrial sands are not on a parity with those for construction sands, they are greatly reduced.

A comparison betwen the new and old freight rates from some of the eastern producing districts to certain leading consuming points follow:

FREIGHT RATES ON ALBANY MOLDING SAND

To	Old Rates	New Rates effective July 1
Boston	$2.90	$2.25
Hartford	2.90	2.00
Newark	2.90	1.80
Philadelphia	2.90	2.10

PROVIDENCE CORE SAND

Boston	1.60	1.25
Hartford	1.80	1.60
Newark	3.70	2.65
Philadelphia	3.70	2.95
Buffalo	3.80	3.40
Cleveland	4.10	3.95
Chicago	5.70	4.75

AMBOY MOLDING SAND

Hartford	2.90	2.25
Philadelphia	1.50	1.00
Pittsburgh	5.60	2.70
Buffalo	5.40	2.70

SOUTH JERSEY SANDS, DORCHESTER GRAVEL AND WASHED SILICA SANDS

Boston	4.10	3.30
Hartford	4.10	2.80
Newark	1.45	1.20
Pittsburgh	3.40	2.70
Buffalo	3.40	2.80

SOUTH JERSEY SANDS, STRONG SILICA STEEL SANDS, SAND BLAST SANDS

Boston	4.10	3.30
Hartford	4.10	2.80
Pittsburgh	3.40	2.70
Buffalo	3.40	2.80

In constructing the Field building, Chicago, 3244 aluminum spandrels, totaling 400,000 pounds, were employed.

Jokes and costumes never change

The Adventures of Bill

BY PAT DWYER

BEFORE I show you this immortal piece of literature," Bill gently waved a long newspaper clipping, "I want to ask you if you remember the amateur minstrel troupe in which you and I performed with a remarkable degree of grace and distinction away back in the dark ages before we were yet out of our time."

"Them wuz the days," I sighed happily and vulgarly. "No bills to pay, no lines to write; work all day and play all night. Why bring that up? Is that clipping, perchance from a newspaper of that era? A treasured souvenir containing a glowing account of the superb and professional performance of each and every one, the magnificient costumes, the drolleries of Mr. Bones and Mr. Tambo, the poise and sang froid of the Interlocuter, usually pronounced in-ter-la-kyooter, the topical songs by the solo artists and the truly soul stiring choruses by The En-tire Compan-ee."

"Well," said Bill, "I'll tell you. On the one, or left hand, I regret to admit that this clipping is from a paper published a few weeks ago. On the other or right hand, I am greatly pleased to find that—at least in this particular instance—your memory is fair to middling. Therefore, my dear lad, you doubtless will recall that on one epic occasion Mr. Bones asked Mr. Tambo how the new minister compared with the former pastor. Mr. Tambo rolled his eyes and stated emphatically there was no comparison between the two men. 'You-all should heah de new Rev'und Jones pray. Why, he asked de Lawd fo' t'ings dat ouah fawmah pastah didn't even know He got!'

"Man and boy," Bill continued impressively, "I have been in the foundry for over 40 years and rather flattered myself that I was familiar with the various details of foundry practice. Pride, as old what's-his-name says, goes before a fall. In this story which appeared recently in a newspaper, a brilliant young author discusses modern foundry practice in a manner that never has been attempted before. Wait 'til you hear of the poisonous fumes with which the shop is filled and the emergency valve which apparently is a part of every well equipped modern foundry. I am ashamed to say that up to the present I never had either seen or heard of this truly remarkable device. The story is headed *Afternoon Tea*, but to my mind a more appropriate title would be *Apple Sauce*. An explanatory line under the title warns the reader that the reading time is 5 minutes and 45 seconds. I didn't clock the course, but offhand I should say that this time is 5 minutes and 45 seconds too long. Unless, as in this particular instance we canter around the track for the pure pleasure of watching a writer make a goat of himself. Listen:

If Jerry Gnatz had not been such an inveterate practical joker, he would have been regarded with considerably more tolerance by W. J. Rudge as a prospective son-in-law. But Jerry apparently was incurable.

Jerry had his molder's ticket when he was barely past 21. He was making a man's wages and a pretty good man's at that. He was steady sober and reliable, and when he began sparking Ailsa Rudge before that vivacious young lady was out of high school, her father was secretly pleased.

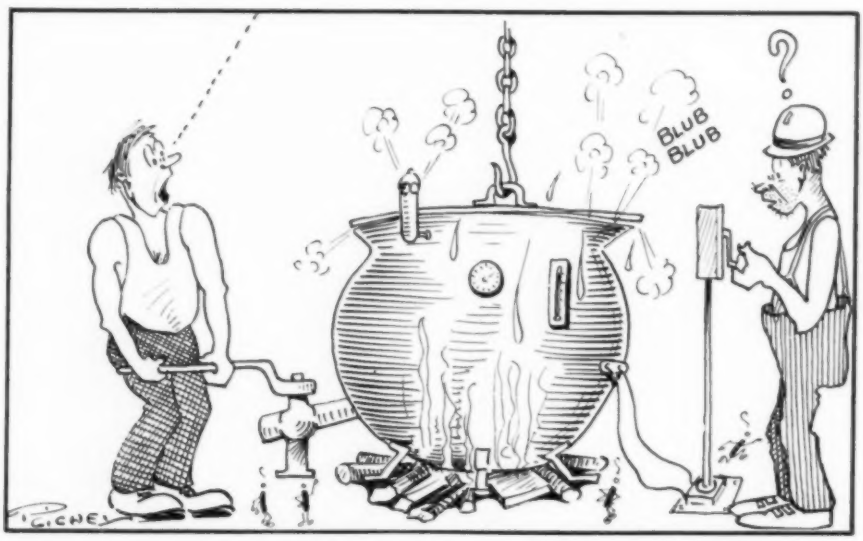
"One of these days," Old man Rudge told Tim Blue, his grizzled foreman, "I'll be wanting to retire. I'll let Jerry buy into the business and we'll keep it in the family."

("Loud cheers," Bill interpolated, "from old grizzled Tim.")

The Rudge factory was located in a huge factory building ("Think of that," said Bill, "a factory in a factory building") monument to an over enthusiastic promotion for an automobile tire manufacturing venture that had blown up like a bubble and cost the citizens of Bagville a sizable fortune ("That's a neat touch," Bill grinned. "The citizens of Bagville left holding the bag.")

Every afternoon at 3 o'clock the day's work in the foundry reached a climax of exciting drama. That was when the huge, electrically heated cauldron of molten metal, bursting with three to five tons of sizzling, white hot daily "pour" was opened

(*Concluded on page* 68)



Emergency valve shown at left probably will revolutionize melting practice

ON TO THE A. F. A. CONVENTION AT TORONTO

EXPOSE YOURSELF TO A GOLD MINE OF HELPFUL IDEAS FREE FOR THE TAKING

ON TO TORONTO

THE valuable time unselfishly devoted by leaders in the Foundry Industry to the preparation of their talks covering many problems and developments current in this business warrants large and eager attendance.

•

The purpose of the Convention is that of assembling for the free giving and taking of counsel and advice. The discussions at every public and private meeting are always heavily laden with helpful ideas and suggestions for the improvement of methods, products and profits.

•

It is wise policy to meet with those directly associated with you in the business of producing metal castings. Not only will you take away knowledge that will be of material value, but, in the exchange of views, opinions and experiences, you will also leave with others something of equal value.

• • •

For fifty years Tabor Molding Machines have kept pace with the developments and improvements in the industry. Today they adequately fulfill the needs of modern foundry practice for precision and production. The Tabor Line includes machines of all types and sizes. Therefore, there is a RIGHT Tabor Machine available for YOUR work.

•

Likewise, The Tabor Line of Foundry Equipment is equally inclusive and reliable, and readily applicable to the individual needs of your operations.

TABOR

TRADE 1884 MARK

THE TABOR MANUFACTURING CO.

6225 TACONY STREET

PHILADELPHIA, PA.

ESTABLISHED 1884

For All-Round Satisfaction—Depend Upon Tabor Machines and Equipment

(*Concluded from page* 66)

to give forth its hissing contents to huge ladles.

When the seething cauldron had spewed its burden and the hundreds of sand cores were filled with stiffening gray iron, the cooling process started. Booms of a giant crane lifted off the top of the metal pot and the poisonous fumes drifted out of the great cupola that rose from the top of the structure like a grotesque wart ("Now you know," said Bill, "what a cupola is for,") Jerry Gnatz always kidding called this daily drama of man's triumph over nature "Afternoon Tea." ("Can you imagine," said Bill, "anything cuter than that?")

On the frequent occasions when Jerry found himself ostracized from the company of Ailsa Rudge, he took vicarious comfort in playing big brother to young Joe, who regarded him already as a member of the family.

On a warm Saturday in the late spring Joe arrived at the foundry early in the morning and watched the core makers at work. Sitting with Jerry during the noon hour, Joe said: "Say, Jerry, I been seein' some big birds, gee, I guess they must be hawks, or maybe eagles, and it looks as if they got their nest up in the eaves somewhere."

"They're not eagles or hawks, kid," Jerry told him. "But they might be swallows. There's millions of swallows around this time o' year."

"Aw' they're bigger'n swallows. Gee, I wish I could get me some eagle eggs or some hawk's eggs for my collection." ("Don't you just love this innocent ungrammatical prattle about hawks and eagles building their nests in the eaves of a foundry? Wait," said Bill, "you will be surprised.")

Lunchtime over, Jerry immediately forgot all about Joe in his rush to complete his day's work in time for the "afternoon tea." The foundry was rushing through a big order for the railroad company—ten tons of gray iron castings for freight car repairs had to be ready. That meant every man working at top speed and the huge cauldron gorged to its capacity with the raw material that would be transformed by the mysterious alchemy of heat into new parts for gondola cars.

Toward 2 o'clock the high pressure heat was put on the metal pot. Within the high ceilinged foundry the heat grew terrific. A sense of impending climax hung in the air. Men stripped down to dungarees and heavy boots labored swiftly, silently against time. The "pour" was to be the heaviest of the season, fully five tons, all the pot could hold.

A quarter of an hour before the zero hour, old man Rudge himself came from the office to take counsel with Jim Blue. Off went the boss' clean clothing and in its place a pair of blue overall trousers and boots reinforced against droppings of molten metal. ("Hold your breath now," Bill warned. "You'll need it.")

The Old Man stood now, hands at the controls, ready to open the steel and alloy maw that would send the first trickle of liquid iron into the big ladle.

Jerry Gnatz straightened up expectantly to watch the performance, like the lifting of the curtain on a play. His forearm wiped the perspiration from his grimy face. Glancing up toward the roof, he started in alarm and let out a yell that rose above the droning roar of the foundry and stayed the hand of the Old Man.

Jerry pointed toward the open vent

Nest of famous blue eagle

where sunlight shone through the cupola. All the men followed his gesture. Nothing there, just the open skylight.

"What's the matter?" Old Man Rudge roared.

"It's Joe," Jerry bellowed back. "Don't open her up! Joe's up there on top. The heat will burn him to a crisp!"

The Old Man answered, "What's this d—— nonsense? Nobody's there."

"I tell you I saw him. He's dodged up on the roof somewhere."

"Sounds like one of Jerry's jokes," Jim Blue said to the Old Man.

"Sure. That's what it is. All right, boys, we'll pour."

Jerry gesticulated helplessly. Taking their cue from Rudge and Blue, the men began to laugh. Jerry's reputation was too well known. Wasn't it just like him, at this tense moment, to try to throw a scare into everybody and then have a good laugh?

"Stop!" Jerry yelled in a final plea. "I tell you I saw the kid up there. He's looking for a hawk's nest."

At this Jim Blue guffawed loudly. The Old Man bellowed.

The metal pot stood between the molding room and the core room. Jerry dashed from his post, around the corner of the huge pot, out of sight of the other men. He knew he had seen Joe Rudge. He blamed himself for goading the boy on to his present perilous plight. He knew, too, that there was only one way to save the lad from being scorched alive should the full heat of the gaseous, poisoned fumes be loosened on the cupola from the fiery breath of the cauldron.

The emergency valve! ("Here it is," said Bill. "Absolutely unique. The only one of its kind in existence.")

It was three feet off the floor. The huge wrench with which it was operated had not been used in years. It stood in its place handy to the valve.

Jerry seized it.

There would be no afternoon tea that day. Jerry Gnatz knew it. He was going to scatter the "tea" over the dirt floor of the deserted core room. He'd be lucky to get out of it alive, but there would be no imprisoned lake of white hot liquid to spew its virulent fumes at Joe. The emergency valve would empty the metal pot in less than a minute.

He gave a gigantic twist to the wrench. The valve opened. A seething mass of liberated fury vomited to the ground, writhing like a great silver serpent of fire, hissing and exploding when it met pools of water.

Jerry held his hands over his face to ward off the horrible heat. His eyebrows were singed away and his skin seared scarlet. He shut his eyes and staggered backward, trying to flee out of the deadly range. And then he knew no more ("Which seems to place him pretty definitely in the same class with the author.")

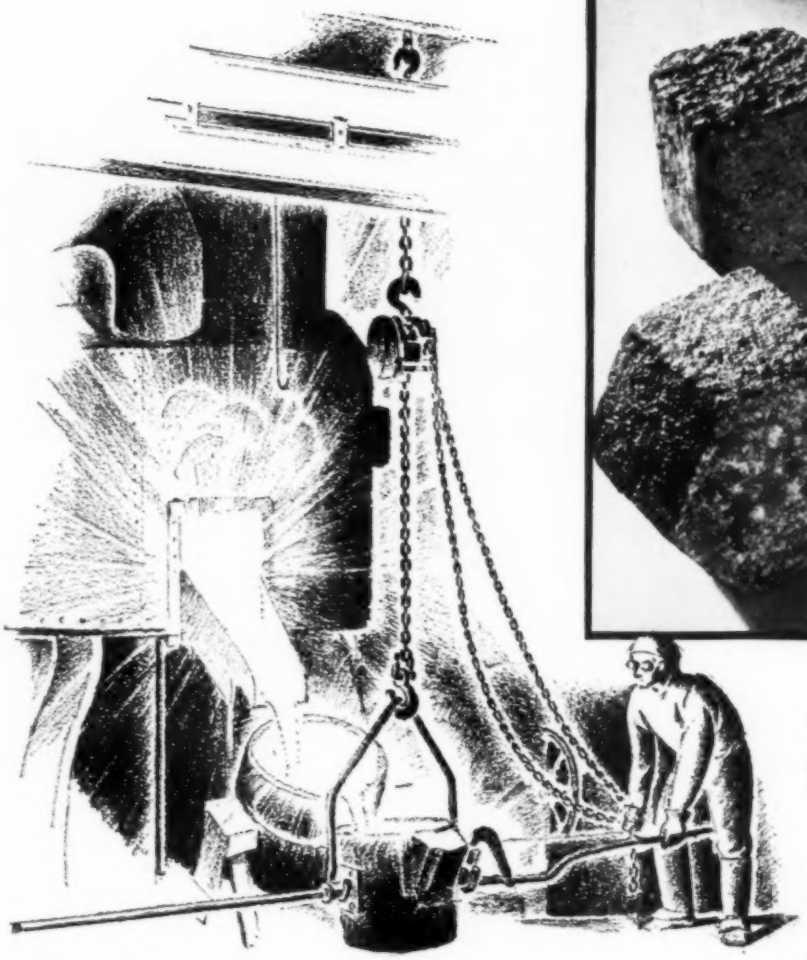
THE END

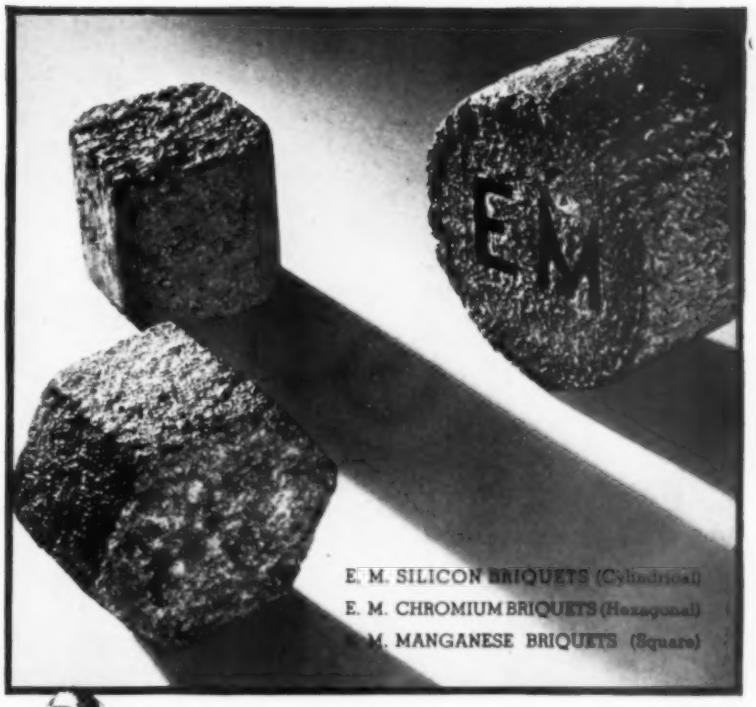
"And about time," I said. "Of all the absolute drivel, that story certainly sets a new high record. What are you going to do about it?"

"Why," said Bill, "I was thinking maybe I could borrow that emergency valve and exhibit it at the A.F.A. convention in Toronto. Some of the boys might be creeping around the roof of the Royal York looking for hawk's eggs during a heavy "pour."

Forms Sand Company

Brighton Sand Co., 1310 Majestic building, Detroit, recently has been incorporated by John Harding. Pits are located near Brighton, Mich., and will be operated under the supervision of M. E. Duckworth.





HIGH CHROMIUM CUPOLA IRON

High chromium cast irons are made in the cupola as well as in the electric furnace. These cast irons contain as high as 20 per cent chromium. E. M. Briquets make possible the successful production of the cupola grade of high chromium iron.

E. M. Chromium Briquets for cupola addition insure uniform recovery and complete solution of the chromium. They make possible better control of chemical analysis and physical structure. They can be conveniently handled during charging. Time is saved. Density of grain is increased. Better castings are produced at lower cost.

Electromet Metallurgists will gladly explain how to use E. M. Briquets. A request will bring complete information.

PRODUCTS OF A UNIT OF UCC UNION CARBIDE AND CARBON CORPORATION

ELECTRO METALLURGICAL COMPANY
Unit of Union Carbide and Carbon Corporation
UCC
CARBIDE and CARBON BUILDING
30 EAST 42nd STREET, NEW YORK, N. Y.

Electromet
Ferro-Alloys & Metals
27-M

Equipment Makers Will Meet in Toronto

Manufacturers of foundry equipment and their representatives will hold a dinner meeting in the Royal York hotel, Toronto, Tuesday evening, Aug. 20, under the auspices of the Foundry Equipment Manufacturers' association. The meeting will open with a dinner at 7 p.m., and will be followed by a program which will include the consideration of subjects of importance to the foundry equipment industry at the present time.

B. J. Flynn, assistant to the administrator, Federal Housing Administration, Washington, will speak on the subject "How the Federal Housing Administration Can Help You Sell Foundry Equipment". Recent changes in the F.H.A. act indicate an unusual interest in the subject of this talk.

Thomas W. Pangborn, Pangborn Corp., Hagerstown, Md., and president of the National Founders' association, will speak on "Effect of Federal Legislation on the Foundry Equipment Industry". His experience as a manufacturer of equipment and the experience acquired through his association activities provide an excellent background for this discussion.

Samuel John Frame, secretary and trustee, Metal exchange, Toronto, will present the final discussion on "Co-Operation in Industry". Mr. Frame has been a keen observer of business trends and industrial co-operative efforts in both Canada and the United States.

All manufacturers of foundry equipment and their representatives attending the Toronto convention of the American Foundrymen's association are cordially invited to attend the meeting.

Store Patterns by A Simple Letter System

Many systems are in vogue for numbering patterns. Obviously the system adopted in any given plant will depend to a considerable extent on local conditions, for example on the total number of patterns, or on the general character of these patterns. In a general way it may be said that all systems are based on a segregation of patterns into arbitrary groups. These various groups then are subdivided into as many minor classifications as may be considered necessary and listed under various combinations of letters and figures. Thus the gears might be listed under *A*, pulleys under *B*, sheaves under *C*, pipes under *D*, plates under *E* and so on.

If further condensation is necessary, all wheels might be listed under *A* with the gears marked 1 *A* 1, 1 *A* 2, 1 *A* 3, etc. The pulleys then would be marked 2 *A* 1, 2 *A* 2, 2 *A* 3 and so on. This numbering system can be extended indefinitely by prefixing a number to the letter to indicate the classification, and affixing a serial number after the letter. Patterns made on the plant, and outside patterns fall into the same classification for numbering.

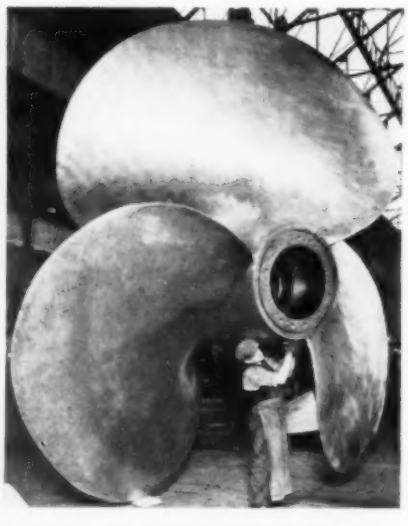
In connection with this system a card index is kept on file in the pattern shop, with a duplicate file, if considered necessary, in the general office and another in the pattern storage building. The cards are filed in the usual manner under *A*, *B*, *C* and so on. In the *A* drawer or compartment the 1 *A* cards would be followed by the 2 *A* cards in regular serial order and the *B*, *C*, *D*, etc., compartments are arranged in the same manner. In addition to the letter and serial number each card carries any additional necessary information, including drawing number; aisle, shelf or other space in the pattern storage building; customer's name; number of coreboxes and loose pieces, principal dimensions, weight of casting, etc.

Normandie Uses Four Large Propellers

Four propellers, each weighing 37 tons as cast, and 23¼-tons when finished, were poured at the Charlton Propeller Works, of J. Stone & Co., Ltd., Deptford, London, for the new French superliner S. S. NORMANDIE, which made her maiden trip early in June. The propellers, which are nearly 16-feet in diameter, are three bladed and have a variable pitch.

In building the mold, 15,000 bricks were used, weighing approximately 43 tons, and in addition, over 20 tons of sand and 30 tons of iron and steel were employed making the completed weight of each mold over 100 tons. Molding time required six weeks, the pouring 15 minutes, and the cooling in the mold, 10 days.

A view of a finished propeller is shown in the accompanying illustration.



The finished propeller for the Normandie weighs 23¼ tons

Toronto Leads As a Foundry Center

(*Concluded from page* 32)

Ltd., Toronto, casts iron pipe centrifugally by the deLavaud process. The sand spun method is used at the plants of the Dominion Wheel & Foundries Ltd., Toronto and the Gartshore Thomson Pipe & Foundry Ltd., Hamilton.

The Dominion Radiator & Boiler Co., Ltd. and the Standard Sanitary Mfg. Co. Ltd., Toronto, and the Port Hope Sanitary Mfg. Co. Ltd., Port Hope, are among the companies producing sanitary ware. Interesting statuary is produced by the Architectural Bronze & Iron Works, Toronto. Steel castings are produced in the extensive plant of the Dominion Foundries & Steel Ltd., Hamilton; malleable iron castings at Fittings, Ltd., Oshawa, and brass at the Sully Brass Foundry Ltd., Toronto, and numerous others.

Details of the plant visitation program are presented on page 28 of this issue of THE FOUNDRY.

Publishes Standards On Drafting Practice

Standards for drawings and drafting room practice, including arrangement of views, line work, dimensioning, sheet sizes and lettering, as approved by the American Standards association, recently has been published by the sponsor organizations, the Society for the Promotion of Engineering Education and the American Society of Mechanical Engineers, 29 West Thirty-ninth street, New York.

Nominates Officers For Engineering Society

American Society for Mechanical Engineers, New York, has announced the following nominations for officers for 1936: President, W. L. Batt, SKF Industries, Inc., Philadelphia; vice presidents, A. D. Bailey, Commonwealth Edison Co., Chicago; J. E. Hunter, University of Colorado, Boulder, Colo.; R. L. Sackett, Pennsylvania State college, State College, Pa.; W. A. Shoudy, Orrok, Myers & Shoudy, New York; managers, W. L. Dudley, Western Blower Co., Seattle, Wash.; W. C. Lindemann, A. J. Lindemann & Hoverson Co., Milwaukee; and J. W. Parker, Detroit Edison Co., Detroit.

Your Surface Grinding—

Is It Heavy Duty Work or Light Tool Room Jobs?

There Are Norton Wheels for All Kinds

Fiftieth Norton Year 1885-1935

YOUR surface grinding jobs may not be as spectacular as the one illustrated above; they may not be as delicate as the one shown below . . . but no matter what they are you can be sure that there is a Norton Wheel that will do them right. There are very definite reasons why Norton Wheels (straight, cup, cylinder and segmental) can reduce surface grinding costs and you'll find these reasons explained in a new folder. Send for your copy—no obligation.

NORTON COMPANY, WORCESTER, MASS.
New York Chicago Detroit Philadelphia Pittsburgh
Hartford Cleveland Hamilton, Ont. London Paris
Wesseling, Germany

W-518

Superheating Cupola Melted Iron

(*Continued from page* 35)

in a similar manner. The temperature of the cupola melted metal at the spout was 2830 degrees Fahr. and test bars were cast in the temperature range of 2500 to 2610 degrees Fahr. The superheated metal was heated to 3004 degrees Fahr. and test bars poured at slightly below that temperature. After superheating silicon and carbon were added to the bath to reduce chilling tendency to about the same as the original cupola melted metal and test bars poured in the temperature range 2645 to 2700 degrees Fahr. Chemical analyses and physical tests made on the three sets of bars of the third series are given in Table III, and transverse load-deflection curves are given in Fig. 6.

Chill test bars 1.5-inches square by 6.0-inches long cast against 2.0-inch metal chills were used to determine relative chilling tendency of the three metals with the following results:

Metal	White	Mottled	Fine gray	Slightly coarser
	In inches			
Cupola	1/32	0	28/32	Balance
Superheated	4/32	8/32	24/32	Balance
Superheated plus silicon and carbon	3/32	0	29/32	Balance

As a further check on chilling tendency of the three metals, a wedge test bar was used, the bar being 5 inches long with a triangular cross section. The base of the triangle was 0.5 inches.

Width of the wide portion of the fracture was measured at the widest point with the following results:

Metal	Width in Inches
Cupola	2/32
Superheated	5/32
Superheated plus silicon and carbon	3/32

Micrographs of specimens taken from the cast tensile bars of the third series are shown in Fig. 5. The unetched micrographs showing graphite particles size and distribution are at 100 magnification. The etched micrographs showing structures are at 250 magnification. Superheating in the case of the third series has resulted in a decrease in all the desired physical properties with an increase in average hardness and chilling tendency. Additions of silicon and carbon to the superheated metal decreased hardness and chilling tendency with very little change in the various physical properties.

In considering the data given it should be borne in mind that the temperature of the cupola melted metals were all 2800 degrees Fahr. or above at the cupola spout. The metals were probably higher in temperature when passing through the melting zone. Temperature readings taken on the cupola bed coke just after the cupola bottom was dropped ranged from 2990 to 2950 degrees Fahr. and the coke was cooling from the instant it left the cupola.

The tests indicate that superheating of cupola melted, steel-mix, alloy iron, melted at high temperature

(*Concluded on page* 74)

Table I

Chemical Analysis and Physical Properties

Metal	Si.	C.	Gr.	C.C.	S.	P.	Mn.	Ni.	Cr.
Cupola	2.28	3.21	2.75	0.46	0.084	0.241	0.60	0.42	0.18
Superheated	2.19	3.22	2.63	0.59	0.086	0.244	0.63	0.40	0.20
Superheated and Cooled	2.20	3.22	2.68	0.54	0.089	0.243	0.52	0.40	0.19

	Transverse bar Brinell	Transverse bar Rock. *B*	Tensile Bar Brinell	Tensile Bar Rock *B*	Tensile Strength p.s.i.
Cupola	187	93.7	196	91.5	37,085
Superheated	207	96.5	212	94.6	37,775
Superheated and cooled	207	96.0	207	93.2	37,205

	Transverse Test Load-Pounds	Transverse Test Deflection-In.	Modulus of Rupture p.s.i.	Modulus of Elasticity p.s.i.
Cupola	2470	.310	65.5 x 10^3	12.3 x 10^6
Superheated	2325	.235	61.5 x 10^3	13.9 x 10^6
Superheated and cooled	2260	.230	59.8 x 10^3	15.7 x 10^6

	Transverse Inch-Pounds Total	Resilience Inch-Pounds Per cubic inch
Cupola	439.0	21.6
Superheated	303.0	14.9
Superheated and cooled	292.0	14.4

Table II

Metal	Si.	C.	Gr.	C.C.	S.	P.	Mn.	Ni.	Cr.
Cupola	2.44	3.30	2.72	0.58	0.091	0.348	0.51	0.19	0.05
Superheated	2.39	3.24	2.69	0.55	0.096	0.350	0.44	0.17	0.04
Superheated plus 0.10 per cent silicon	2.47	3.24	2.75	0.49	0.093	0.347	0.45	0.17	0.05

	Transverse bar Brinell	Transverse bar Rock. *B*	Tensile Bar Brinell	Tensile Bar Rock *B*	Tensile Strength p.s.i.
Cupola	196	92.5	192	91.2	31,335
Superheated	192	94.0	204.5	93.3	34,675
Superheated plus 0.10 per cent silicon	196	94.5	196	92.1	35,420

	Transverse Test Load-Pounds	Transverse Test Deflection-In.	Modulus of Rupture p.s.i.	Modulus of Elasticity p.s.i.
Cupola	2025	0.275	53.5 x 10^3	12.1 x 10^6
Superheated	2475	0.305	65.5 x 10^3	12.7 x 10^6
Superheated plus 0.10 per cent silicon	2375	0.280	62.8 x 10^3	12.0 x 10^6

	Transverse Inch-Pounds Total	Resilience Inch-Pounds Per cubic inch
Cupola	320.0	15.7
Superheated	427.0	21.0
Superheated plus 0.10 per cent silicon	336.5	17.0

Table III

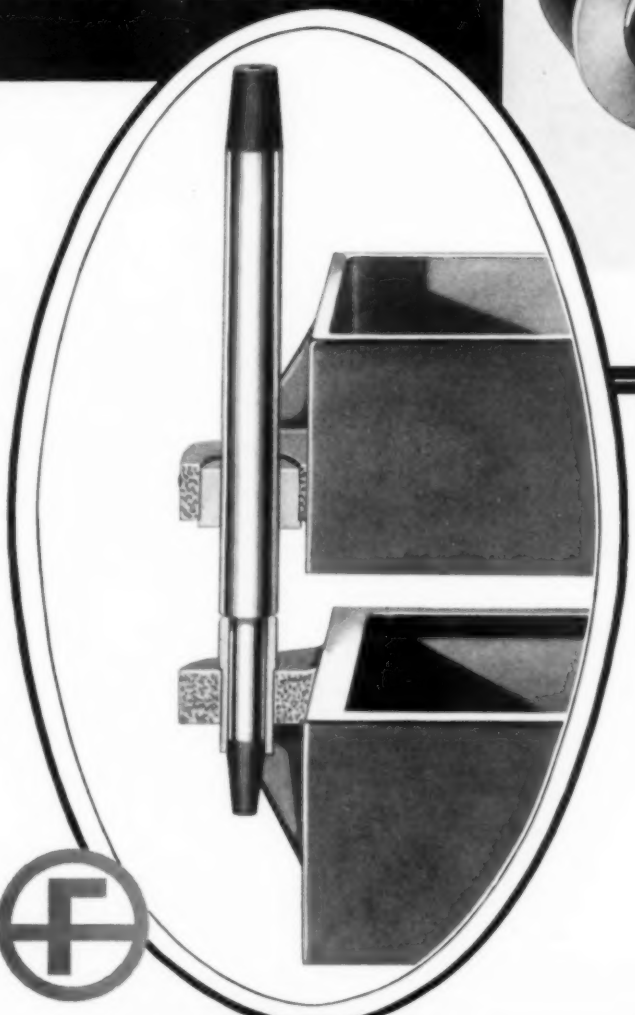
Metal	Si.	C.	Gr.	C.C.	S.	P.	Mn.	Ni.	Cr.
Cupola	2.29	3.24	2.72	0.52	0.063	0.238	0.66	1.72	0.63
Superheated	2.30	3.25	2.65	0.60	0.069	0.238	0.65	1.72	0.62
Superheated plus silicon plus carbon	2.39	3.33	2.77	0.56	0.074	0.234	0.62	1.73	0.60

	Transverse bar Brinell	Transverse bar Rock. *B*	Tensile Bars Brinell	Tensile Bars Rock *B*	Tensile Strength p.s.i.
Cupola	228	99.0	228	98.3	44,490
Superheated	223	99.2	235	99.3	40,515
Superheated plus silicon plus carbon	207	97.2	228	98.5	40,630

	Transverse Test Load-Pounds	Transverse Test Deflection-In.	Modulus of Rupture p.s.i.	Modulus of Elasticity p.s.i.
Cupola	2550	0.260	67.5 x 10^3	13.6 x 10^6
Superheated	2420	0.235	64.0 x 10^3	14.4 x 10^6
Superheated plus silicon plus carbon	2325	0.240	61.5 x 10^3	13.3 x 10^6

	Transverse Inch-Pounds Total	Resilience Inch-Pounds Per cubic inch
Cupola	353.5	17.4
Superheated	309.5	15.2
Superheated plus silicon plus carbon	303.5	15.0

Interchangeable FLASK PINS AND BUSHINGS



Four *Reasons* why you can *Positively* Cut Production Costs with

Interchangeable Flask Pins —and Bushings

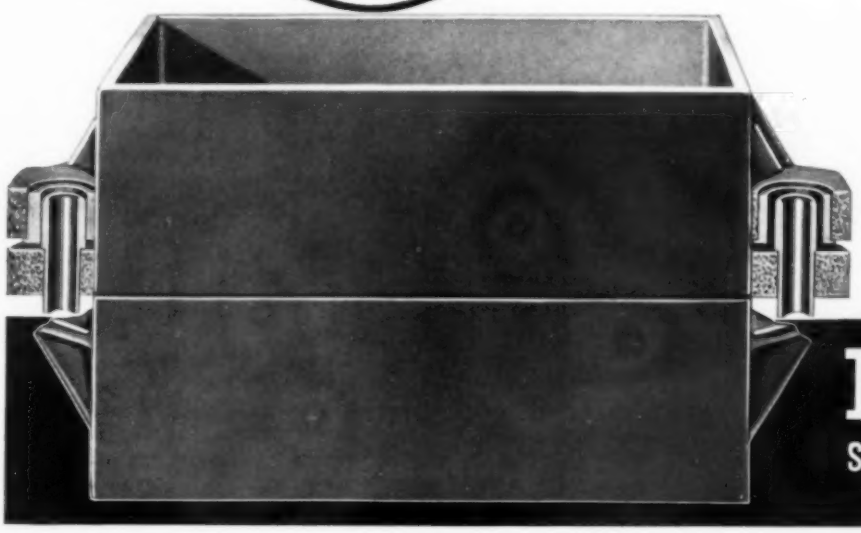
1—They eliminate ear wear and breakage

2—They prevent wedging

3—The drag cannot shift

4—Easily and inexpensively installed with standard reamers

Write for new descriptive bulletin.



Manufactured and stocked only by

FEDERAL SCREW WORKS

Sole Licensee

DETROIT, MICHIGAN

FEDERAL

SCREW WORKS·DETROIT

(*Concluded from page* 72)
in the cupola, is of no particular advantage except that of higher temperature only. In the case of plain iron or very low alloy content iron, made with a pig-scrap mixture in the cupola, a decided improvement was found by superheating the metal. Microscopic examination of the various metals showed little change in graphite size and distribution in the alloy irons but did show improvement in the plain pig-scrap iron of the second series.

Phosphor Copper Made by Several Methods

Two methods of manufacture of phosphor copper are available. The more common is that of melting copper to the proper temperature and submerging in that bath of molten copper, a phosphorizer, in which a number of sticks of phosphorus previously had been placed. The phosphorizers are made of graphite. They comprise a tool to be put on the end of an iron rod by inserting the iron rod in a hole at one end. The other end has a larger hole in which the phosphorous is placed and held there by a paper stuck around the phosphorus. The top or upper side of the hole in which the phosphorus is placed has a hole connecting it to the outside so that when the phosphorizer is immersed in the copper, the phosphorus or molten metal or both may circulate up through the cavity for holding the phosphorus and out through the last described hole again to the bath.

It takes considerable skill to avoid excessive phosphorus loss in that process and, of course, the lost phosphorus immediately combines with the air and makes an oxide of the phosphorus, which floats in the air, has a pungent odor and is highly poisonous. Because of the danger of poisoning from phosphorus, only those who are experienced and skilled in the manufacture of phosphor copper should be trusted with that work.

The other method, which is patented, consists of heating copper chips or borings in a closed container in the presence of a given amount of phosphorus at a red heat, somewhat below that of the melting point of copper. Phosphorus and copper combine and form the desired phosphor copper. This process obviously is much safer as the loss of phosphorus is relatively small and consequently the danger of phosphorus poisoning is reduced materially. Of course, that process requires additional melting of the product after the combination has taken place in the retort; but that melting is done at such a low temperature that it is of relatively little moment. In either of these processes after the compound is formed, it is poured into the desired molds.

It also should be noted that the normal solution of phosphorus and copper is somewhat below a 85-15 ratio; 14 and a fraction per cent of phosphorus is the maximum that the copper will take up. After that there is a surplus of phosphorus present, which gives the usual 85-15 per cent product that greasy feeling when it is handled.

In the manufacture of phosphorcopper, it should be borne in mind that to maintain a given ratio of phosphorus to copper, the necessary allowance for that phosphorus lost in the process of manufacture must be made to insure the product containing all the phosphorus desired. This consequently increases the consumption and in turn the cost of the finished product, and also is one of the things that requires experience and knowledge to insure a uniform product. In other words, a careful laboratory control of each and every heat is essential to avoid a very irregular product.

Attention should be given to the very great danger to operators handling stick phosphorus. Unless they are experienced in this, they may be seriously burned and the burns frequently give great trouble in healing. Phosphorus bursts into flame the moment it contacts with air.

Book Review

Atlas Metallographicus, sections 12, 13 and 14, by Heinrich Hanemann and Angelica Schrader, paper, 8 x 11 inches, section 12 contains 8 tables and 68 illustrations; section 13 contains 4 tables and 34 illustrations, and section 14 contains 8 tables and 69 illustrations, published by Gebrueder Borntraeger, Berlin, Germany, and supplied by THE FOUNDRY, Cleveland, and in Europe by the Penton Publishing Co. Ltd., London.

These sections are a continuation of a series on the metallography of iron and steel and are arranged in the form of explanatory text matter, tables and illustrations carefully prepared from micrographs. Section 12 deals with structure changes in soft steel under tension tests, data from the structure of ruptured specimens, structure appearance of cementite in strained pieces, structure appearance in upset pearlitic steel, fine segregation in upset steel after heating, recrystallization in soft iron after heavy upsetting, and after less heavy upsetting, and micrographs showing the effect of working.

Section 13 includes a continuation of the latter portion of the previous section, data on the influence of the upsetting or working process on recrystallization, grain size of low carbon steel after recrystallization, grain size after recrystallization and grain transformation under the influence of various carbon contents, recrystallization under a ball impression with various annealing temperatures and times in low carbon steel, recrystallization, examples for the investigation of creep in iron and steel, and creep or flow in a cylindrical specimen of soft iron under torsion.

Section 14 contains a continuation of the text matter from one of the earlier sections and discusses the surface sheen of a polished specimen, and its use in determining crystal orientation, slipbands, cementite, pearlite, slags and segregations. The procedure in cold-worked steels with heating, and examples for structure formation in worked iron and steel also are discussed. Section 14 also contains a complete index of Part 1 of which it is the final section. The index is rather complete listing the material under subject headings, as the various sections with the tables, illustrations and subject matter of each, a name index of various authors mentioned, and finally an alphabetical index.

Foundry Accident Rate Given in Report

Based on reports of 95 organizations, a 50 per cent increase in accident severity rates is shown for foundries in 1934, according to the National Safety council. Foundry industry averaged 23.42 in frequency, as compared with 15.29 for all industries, and 2.21 in severity as compared with 1.70. The injury frequency rate is determined by the number of disabling injuries per million man-hours of work, and the injury severity rates on the number of days lost through injury per 1000 man-hours of work.

The 1934 frequency rate of the foundry industry was 50 per cent higher than the average for all industries, and the severity was 30 per cent higher. However, the industry has made more than average progress in reducing injury rates since 1926. It has decreased the frequency rate 61 per cent and the severity rate 60 per cent. All industries have averaged 57 per cent decrease in frequency and 37 per cent decrease in severity. The study shows that frequency and severity rates were lowest in large foundries.

Publishes Bulletin

A recent bulletin of the engineering experiment station, University of Illinois, Urbana, Ill., is entitled "Determination of Mean Specific Heats at High Temperatures of Some Commercial Glasses," by Cullen W. Parmelee and Alfred E. Badger. The title of this bulletin was given incorrectly on page 47 of the June issue of THE FOUNDRY.

ADVERTISING PAGES REMOVED

Hardens Steel Roll Surfaces

(*Continued from page* 37)

mullers located at the far side of the foundry. It is loaded in boxes and conveyed in a tunnel under the floor to the steel foundry section. The molds are dried in a battery of four large ovens at a temperature of 700 to 800 degrees Fahr., for periods ranging from 12 to 36 hours depending on the size of the mold and the volume of sand contained therein. Owing to the wide range in sizes of rolls, it may be necessary on occasion to make a comparatively small roll in a large flask. Consequently the increased volume of sand will require a longer drying time.

Molds Poured on End

After the molds are dried the corresponding halves are assembled on the floor and clamped, then upended and lowered into pits for convenience in pouring the metal from a bottom poured ladle. A long vertical sprue incorporated in one half of the mold extends from top to bottom and conveys the metal from the pouring cup to a gate set at a tangent to the lower neck a short distance above the wabbler. The pattern forms the wabbler at the lower end, but the upper neck is carried full size past the position of the wabbler and then enlarged for an additional height to form a sink head. The diameter and height of the sink head varies to some extent depending on local conditions. In extreme instances the metal in the sink head may weigh half as much as the casting.

The rolls remain in the molds for 36 to 72 hours after they are cast. Then they are lifted out of the pits, shaken out, cleaned, annealed in large furnaces provided with removable top bungs, and later transferred to another section of the same bay where the heads are cut off, in special type heavy duty lathes. Some of the rolls are shipped from this point, while others either are rough turned, or completely finished.

Steel rolls are annealed twice, first at 1750 degrees Fahr., to break up the dendrites and second at 1450 to 1550 degrees Fahr., depending on the carbon and alloy content. Both anneals are followed by slow cooling, although in some instances the cooling rate after the first anneal may be quite rapid. The holding time at the 1750 degree anneal usually is about 1 hour per inch in diameter of the roll body, followed by 1½ to 2 hours per inch for the anneal at the lower temperature.

The manufacture of rolls for rubber mills is a specialty of the Mackintosh-Hemphill Co., which has developed methods for producing the long hollow rolls wtih clean bodies inside and outside. The core readily is cleaned from the body and journals.

Recently the company has developed a process for imparting an exceedingly hard surface to the face of rolls and other castings made from a proprietary metal. After the initial experiments had been carried far enough to indicate that the treatment was satisfactory for smooth rolls employed in the rubber industry, similar experimental and service tests were conducted on corrugated rolls for cracker, washer and grinder rolls. These rolls replaced chilled or sand cast iron rolls with the corrugations machined into the hard surfaces of the bodies.

The recently developed type of corrugated roll is manufactured in a manner somewhat different from that employed with the smooth roll. After they have been cast and cleaned, they are heat treated to their softest and strongest condition and then completely machined. This includes cutting of the corrugations. These corrugations or teeth then are subjected to the hardening process where the surfaces of the teeth are hardened to between 70 and 80 scleroscope, extending to a depth of 3/16 to ¼-inch. The location, depth and degree of hardness it is claimed can be controlled accurately by this process.

Hardening of the surface does not affect in any way the primitive strength and other characteristics of the backbone of the corrugations, nor of the roll itself. A pair of these rolls completely machined and an enlarged section of the corrugations exhibiting the hardened surface are shown in Fig. 4.

These rolls are cast from a new, high grade, air hardening alloy steel of the following approximate composition: Smooth rolls, carbon 1.00 per cent; nickel 1.50 per cent; molybdenum 0.35 per cent; chromium 1.00 per cent; managanese 0.75 per cent. Corrugated rolls, carbon 0.45 per cent; molybdenum 0.35 per cent; manganese 1.25 per cent. Although developed primarily for rolls used in the rubber industry, it is claimed this proprietary metal has found wide application where strength and wear requirements are extremely severe, for example in track wheels, pulverizer hammers, gears, pinions, cams, etc.

Combined Torch and Spray

Smooth rolls receive four heat treatments. They are normalized, annealed, rough machined, air quenched and then drawn to a hardness of 50-60 scleroscope. The corrugated rolls are annealed and then torch hardened to 80-90 scleroscope. A special device is employed for this purpose, a combined torch and spray. It is claimed that the penetration is under accurate control and introduces no stresses or strains either during or after the application. The process has been patented.

In this process the treatment is confined to any desired area. Briefly it may be said that the original pearlite is changed to the tough, hard sorbite, while avoiding the formation of brittle hard martensite. The process was developed through dissatisfaction with previously existing methods to adequately cover castings of fairly large size, intricate design and of variable cross section.

Carbon and Alloy Steel Rolls

	Carbon	Scleroscope
Carbon steel rolls	Under 0.50	28—30
	0.50—0.70	30—32
	0.70—1.00	32—34
	Over 1.00	34
Molybdenum steel rolls	Under 0.70	.....
	0.70—1.00	.....
	1.00—1.25	.....
	1.25—1.50	.....

Scleroscope hardness varies from 30 in soft annealed grades to 60 in the higher carbon hardened grades.

Manganese alloy rolls	1.20—1.75	36—42
	1.75—2.00	42—45
	2.00—2.25	45—48
	2.25—2.50	48—50
High carbon rolls	2.50—2.75	50—53
	2.75—3.00	53—56

This steel contains high manganese nickel, chromium or molybdenum.

Adamite rolls	1.20—1.30	36—38
	1.40—1.60	36—40
	1.80—1.90	42—45
	2.20—2.30	45—48
	2.50—2.60	50—55

In the common hardening method of heating the entire casting, followed by liquid quenching, a deep penetration of the hardness is accompanied by brittleness and lack of resistance to shock. Case carbonization with subsequent liquid quenching is not considered practical on account of limitations imposed by size and design of the castings and by the distortion produced. Methods involving mold facing with manganese or chromium are possible only in castings to be used in the rough. At the best, these presented hardened surfaces too rough for most applications. The special metal which lends itself readily to this treatment is a strong, shock resisting antifatigue metal showing the following initial physical properties: Tensile strength 90,000 pounds per square inch; elastic limit 65,000 pounds per square inch; elongation 25 per cent; reduction in area 45 per cent.

Section cut from a coupling box with round pods is shown in Fig. 4. The fractured surface was ground and etched to show the depth of artificially hardened or treated area.

Cover Wide Range

With a slight variation in the carbon content the metal will produce castings ranging from strong, tough, antifatigue products at one end of the scale to extremely hard, tough wear resisting castings at the other end. The wide field of application is further broadened by the fact that castings may be hardened locally to beyond file hardness, while the unhardened parts retain their original state. Scleroscope hardness for the soft grade is 25, for medium hard is 40 to 55; for full hardened is 70 to 80 and for castings designed for crushing and pulverizing purposes it is 75 to 85.

This last grade has to a maximum degree the qualities to resist wear, breakage, spalling and peaning. It has the desirable qualities of manganese steel and in addition is claimed to be three times as hard. It is a much stiffer material and will not flow. As it cannot be machined, all finishing is done by grinding.

The Mackintosh-Hemphill Co., has secured the right to manufacture the corrugated cinder pot shown in Figs. 1 and 2. Fig. 2 shows the pot resting in a ring or cradle which in turn is attached to a suitable chassis or frame mounted on wheels set at standard railroad gage.

Claims advanced for this type of pot include elimination of the high maintenance and replacement cost incidental to the conventional design of cinder pots operating in blast furnace and open-hearth departments, pots which crack, break or bulge and become deformed in a comparatively short period.

Alternate expansion and contraction while in service, plus internal strains inherited from the mold are responsible for the limited life of the pots. The vertical corrugations in the type of pot shown in the illustration provide flexibility and permit the walls to expand freely and contract circumferentially under extreme changes in temperature. The wall construction also is stronger than that of a pot with plain sides. Special rigging and methods employed in molding these pots will be taken up later.

This is the third of a series of four articles covering certain practices in the iron and steel foundries operated by the Mackintosh-Hemphill Co., Pittsburgh.

THE EDITORS.

Honor Veteran Sandusky Foundryman

A testimonial dinner was tendered J. J. Carroll, president, G. & C. Foundry Co., Sandusky, O., in honor of his seventy-fourth birthday at his home in that city, July 24. The affair was attended by more than 30 foundrymen, friends and competitors who paid high tribute to Mr. Carroll's attainments.

J. J. Carroll

Mr. Carroll, who was born in Vermont, July 24, 1861, was the son of a foundryman and found employment when only 12 years of age as a coreroom boy in the plant of the National Malleable Co., Cleveland, where with the exception of certain intervals when he was identified with amateur and professional baseball, he continued his foundry work until in 1896 he was made superintendent for the Cleveland foundry. He resigned in August, 1916 to build the G. & C. plant at Sandusky, which was put in service during 1917. Associated with Mr. Carroll are his two sons, Eugene and Charles. The firm specializes in light gray iron castings and manufactures a variety of automotive and special work.

Elect Officers Of Malleable Society

Brinton Welser, vice president, Chain Belt Co., Milwaukee, was elected president and chairman of the board of the Malleable Founders' society at a meeting of the board of directors held in Cleveland, July 11. L. A. Dibble, president, Eastern Malleable Iron Co., Naugatuck, Conn., was elected vice president and vice chairman and Robert E. Belt, Cleveland, secretary and treasurer. The board discussed the industry agreement for self-government relating to maintenance of prevailing wage, hour and trade practice requirements of the malleable iron industry code. Consideration is being given to a plan for publishing prices for certain classes of special castings.

Book Review

Enamels, by Andrew I. Andrews, cloth, 410 pages, published by the Twin City Printing Co., Champaign, Ill., and supplied by THE FOUNDRY, Cleveland, for $5.50 plus 15 cents postage and in Europe by the Penton Publishing Co., Ltd., London.

Any industry should be strengthened through the publication of a comprehensive study of principles and practices utilized by that industry. This work, dealing with the preparation, application and properties of vitreous enamel, carries the endorsement of the fellows of the American Ceramic society and the Porcelain Enamel institute.

The broad scope of this book may be understood through a study of the various chapter headings as follows: History of Enameling; Raw Materials for Enamels; Fundamental Considerations, including physical properties; Cast Iron, Sheet Iron, and Steel; Preparation of Metal Surfaces for Enameling; Enamel Calculations; Enamel Composition; Frit Making; Milling and Mill Additions; Application and Control; Firing; and Enamel Properties and Tests.

The discussion of cast iron includes a brief study of the chemistry of cast iron, the effects of various elements, design of castings for enameling, and a brief study of foundry practice.

The text should be of considerable value to the manufacturer producing materials to be enameled, to the enameler and to the student of ceramics.

NOTE WIDE SCOPE OF OSBORN EQUIPMENT

MOULDING MACHINES . . . . .

Squeezers and Jolt Squeezers
Jolt Rollover Pattern Draw
Jolt Rollover Squeeze Draw
Rockovers
Jolt Strippers
Jolt Squeeze Strippers
Plain Jolts
Vibrators and Accessories

CORE MAKING MACHINES . . . .

Rollover Draw
Core Blowers
Core Box Draw
Plain Jolts

MOULD CONVEYORS . . . . . .

Index
Continuous
Gravity Roller
Monorail

SAND HANDLING . . . . . .

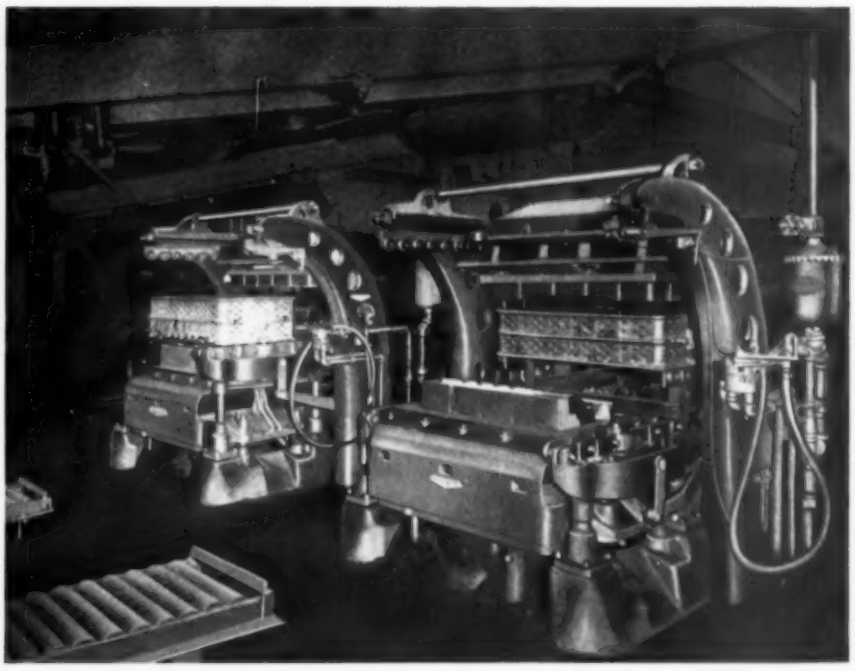
Belt Conveyors
Inclined Belt Conveyors
Elevators
Flight Elevators
Overhead Bins
Sand Storage Bins
Spill Conveyors
Mould Shakeout Machines

SAND CONDITIONING . . . . .

Pug Mills
Pan Mullers
Aerators
Mixers
Screens
Sand Feeders
Clay Feeders
Watering Devices

POURING and MATERIALS HANDLING . . . . .

Note: Osborn Tramrail Systems are made up from combinations of Units selected from the following:
Teerail, Beamrail and Fittings
Switches
Trolleys—Hand or Electric
Hoists—Chain or Electric
Cranes—Monorail; Gantry; Jib; Hand or Electric
Sections—Drop and Transfer Scales; Magnets; Transformers; Elevators
Pouring Devices; Buckets; Grabs; and Special Carriers



New Osborn Jolt Squeeze Strippers are meeting requirements for high-speed, high-quality moulds in the foundry of The Packard Motor Car Company.

LOOKING AHEAD!

Osborn keeps in constant touch with changing conditions that signal the approach of changing requirements in foundry equipment.

As a result, Osborn is prepared with advanced equipment to meet advanced demands.

Osborn engineers are in the strongest possible position to meet YOUR needs promptly, correctly and satisfactorily.

Visit the A. F. A. Convention, Toronto, August 20th to 23rd.

THE OSBORN MANUFACTURING COMPANY

5401 HAMILTON AVE., CLEVELAND, OHIO, U. S. A.

Agencies strategically located all over the world

OSBORN

Gray Cast Iron (*Chapter III*)

(*Continued from page* 39)

has been noted by most observant foundrymen and metallurgists. In effect, then, silicon has a tendency to lower the solubility of carbon in iron. It should be noted here that other elements also change the percentage of carbon required for the eutectic. These will be referred to later.

2—The eutectic temperature is raised with increase in silicon percentage. (Gontermann, Wust, Honda and Murakami, and Hanson). Effects (1) and (2) are depicted in the diagram constructed by Greiner, Marsh & Stoughton, Fig. 61. The lines themselves are based on consideration of the data of Kriz and Poboril. It will be noted that the lower curve indicates a drop of about 0.36 per cent carbon for each per cent of silicon increase within the range of silicon content of interest to the gray iron manufacturer.

3—Silicon diminishes the stability of cementite. This means that cementite graphitizes more readily in the presence of silicon and with an increase in silicon, other factors being constant. Thus, the degree of graphitization under constant cooling conditions, can be modified and changed by change in silicon percentage. In iron of a given total carbon content, the total graphitic carbon percentage is increased and combined carbon decreased when silicon is increased, other factors being constant. For that reason silicon is termed a *softener* in gray iron.

Change May Be All Right

The *softening* or graphitizing action of silicon is more marked in higher carbon irons. Within certain ranges the graphitizing action of silicon is marked and oftentimes the change of white to gray iron is abrupt with but small alteration in silicon content. It is held by some that small percentages of silicon are held within the iron carbide.

4—Although generally overlooked or disregarded, the deoxidizing effect of silicon conceivably has some influence on the gray iron alloys. The concurrent presence of comparatively large percentages of carbon and of silicon undoubtedly precludes the presence of any considerable percentage of oxide in metal melted under normal conditions. This is indicated by the careful researches of Eckman and Jordan—*Transactions*, A.F.A. 1925 pages 431-441—who found 0.14 per cent oxygen the maximum among the various charcoal and coke irons they analyzed. That the presence of oxidizing influences adds to the stability of iron carbide seems well established, and there is reason to believe that the chilling tendencies of gray irons are modified by exposure to oxidizing conditions. It is held by H. A. Schwartz that a stable form of cementite containing oxygen is probable. However, there is little or no data indicating the percentage of oxygen necessary to alter cementitic stability in gray iron alloys. There is considerable evidence which indicates that silicate inclusions of microscopic size in solidified gray irons are conspicuous by their infrequency. That suggests lack of much oxygen in the liquid iron.

Whatever speculative conclusions may be formed, at least it seems safe to assume that silicon modifies the chilling tendencies of cast iron because of its strong deoxidizing action, as well as because of its more direct influence on the structural components.

5—Increase in silicon content raises the temperature of eutectoid formation and lowers the percentage of carbon required for eutectoid formations, about 0.07 per cent carbon for each per cent silicon.

Summarizing, silicon in gray iron:

(a) Decreases the stability of the carbide, thus promoting graphitization. It tends to soften and weaken ordinary gray irons as its percentage is increased. This action is more noticeable in high carbon irons. It also tends to lessen total contraction.

(b) Lowers the percentage of carbon required for the eutectic. This effect often modifies greatly the graphite distribution in irons of like carbon but dissimilar silicon content. We quote the theory promulgated by Sauveur about 1912—which is quite interesting in view of subsequent developments, "(1) To possess maximum strength, cast iron should be of eutectic composition because the graphite particles will then be smaller, which in turn makes for greater strength; (2) the eutectic structure should be produced by high silicon and low carbon content since the latter promotes strength; (3) the cast iron should have an eutectoid matrix because it is the matrix of greatest strength and (4) the eutectic matrix should be produced by high silicon content and rapid cooling because the latter leads to formation of small graphite particles."

Today, over 20 years later, most high strength irons are made with low carbon and comparatively high silicon content, with or without alloy additions. Incidentally, it is easier to hold down carbon content in cupola melting of higher silicon irons. In modern manufacture, care is used to have the strong irons considerably hypoeutectic since if even slightly hypereutectic they readily form coarse graphite and become weak. All in all, Professor Sauveur's prediction has proved remarkably accurate.

(c) The deoxidizing action of silicon probably has an indirect influence on graphitization, and apparently adds somewhat to the fluidity of the iron.

Special Silicon Irons

(d) Silicon in itself changes the eutectic and eutectoid transformation temperatures but this effect may be masked by the effects of other elements. However, silicon lowers the percentage of carbon required for the eutectoid pearlite.

Ordinary gray iron castings rarely exceed 3 per cent silicon content. Silal (5 per cent silicon and about 2.5 per cent total carbon) is a scale and growth resistant cast iron whose structure is composed of ferrite and fine graphite—Norbury and Morgan —*Transactions*, A.F.A.—Vol. 40, 1933, pages 267-275.

Duriron is an iron containing approximately 14.5 per cent silicon and carbon under 1.0 per cent. Graphite formation is avoided. This metal and others of its class have good resistance to many types of acid corrosion.

Generally speaking, the shock or impact resistance of most very high silicon irons is comparatively low.

Table I

Relation of Silicon and Carbon

No. of Test	Silicon per cent	Total Carbon	Freezing point C°	No. of Test	Silicon per cent	Total Carbon	Freezing point C°
1	0.13	4.29	1138	9	3.69	3.32	1197
2	0.21	4.23	1131	10	3.96	3.24	1205
3	0.66	4.05	1152	11	4.86	3.08	1210
4	1.14	3.96	1155	12	5.06	2.86	1215
5	1.41	3.88	1160	13	13.54	1.94	1233
6	2.07	3.79	1175	14	18.76	1.19	1240
7	2.68	3.56	1185	15	26.93	0.87	1255
8	3.25	3.41	1187	....	.....	.....	.....

British Meeting

Autumn meeting of the British Iron and Steel institute will be held at Manchester, England, Sept. 16 to 19. The general meeting will be held on Sept. 17 and 18, and a number of plant visits will be made.

ADVERTISING PAGES REMOVED

I. B. F. Holds Annual Conference

(*Concluded from page* 41)

immediately through erosion and corrosion; the wall linings may be reduced by as much as 50 per cent, and then may not reduce further. He suggested research work to determine the most desirable thickness to start with. He also suggested painting the walls with some composition to produce a glaze.

Frank Russell, General Refractories, Ltd., referred to the present tendency to use high alumina bricks. He emphasized the importance of making (sound) cement joints, as in most cases trouble originated from bad joints made with cement of the wrong composition, or too thick. He also stressed the necessity of using the best type of ganister when that material is utilized.

Prof. Thomas Turner referred to the formation of carbon deposits in the cooler parts of the cupola. Dealing with the strength of refractories, he pointed out that some are stronger than others at high temperatures, although not so good at a lower temperature. Referring to heat losses through bricks reducing in thickness, he said that in some cases it may be more economical to put up with slight losses than to lag the outside of the furnace, which sometimes requires interruption of operations; also, external cooling is sometimes more important than the chemical composition of the lining. Mr. Cooper suggested the use of a combination of refractories, one portion being solid and the other in bricks.

Mr. Rees, in his reply, said that it has been found possible to start a furnace with walls having a reduced thickness, with less deterioration than in thick walls. He said that there were possibilities in the idea of utilizing a combination of refractories.

Study Sand Control

The next paper, "Sand Problems in a Brass Foundry," was by F. Howitt, Pegler's Ltd., Doncaster. A Tipper, referring to the use of bentonite, mentioned in the paper, said that there is a lot to be said for the use of naturally-bonded sand, there being only a comparatively small drop in permeability. Ben Hird stressed the point that if sand control is studied properly, many difficulties encountered in the foundry would be overcome or diminished. In replying, Mr. Howitt said that the advantage of using bentonite as a bond is that it brings the sand under control, as more or less bond can be added as required.

The session of Thursday, July 4, was devoted to the symposium on steel foundry practice. A paper entitled "Some Notes on Ingot Molds" was contributed by Dr. T. Swinden and G. R. Bolsover, central research department, United Steel Companies, Ltd. The discussion was opened by Dr. W. H. Hatfield, who pointed out that costs given by the authors were very low. He stated that for the manufacture of ingots of special steel it is necessary that the inside surface of the molds should be in good condition. In such circumstances the cost of molds is substantially higher than indicated in the paper, and is an important factor in making special steel.

J. G. Pearce said that there are many cases where molds fail, not by major cracks, but owing to crazing or deterioration of the inside walls. He stated that it has been suggested that the iron for an ingot mold should have a high carbon content with fine graphite, a difficult condition to obtain in green sand, but he said that it is now possible to obtain such an iron with from 3.7 to 4 per cent total carbon. If, however, it be found that coarse graphite is required, an iron answering to such conditions can also be obtained. Further investigations should be made in the question of phosphorus content.

Mr. Cooper pointed out that, according to expert German opinion, not sufficient precautions are taken in the preparation of molds before casting the ingot. Another speaker expressed the opinion that more care should be taken in the preparation of the cores and the subsequent cooling of the casting, and stressed the importance of proper sand control.

John Shaw agreed with the authors concerning the importance of the structure of the iron, especially as regards the form and distribution of the graphite. He suggested that molds were made in Germany from mixer metal, and this might account for their long life. He also referred to the beneficial effects of irons alloyed with manganese or chromium.

Mr. Ballantine gave examples of molds, quite similar as to conditions of manufacture, which were supplied to different firms and had very different lives, and he thought that troubles mostly occurred owing to the treatment to which the molds are subjected in the steelmaker's hands.

Professor Andrew questioned whether the chemical composition of the molds underwent marked changes throughout the thickness of the walls, and also the microstructure; also, why the life of molds appeared to be shorter when making alloy steels. Dr. Longmuir suggested that the longer life of German molds might be due to differences of composition in regard to British molds, especially as regards phosphorus content. J. E. Mercer, mentioned cases where the life of molds was increased by more careful and elaborate preparation of the metal.

Dr. Swinden, replying to the discussion, said that he saw no reason why molds should have their life shortened when used for alloy steel. He stated that most molds end prematurely through large cracks and not so much by crazing. He said that in the course of use, the inside surface of ingot molds becomes decarburized, and the chemical composition does undergo changes throughout the thickness of the walls. He agreed with Mr. Shaw concerning the beneficial effect of manganese, but had obtained no good results with chromium.

Steel Castings Improved

The next paper, by Dr. W. H. Hatfield, director, Thos. Firth and John Brown, Ltd., was entitled: "Steel Castings, With Special Reference to Alloy Steels." Dr. Longmuir pointed out that the figures for mechanical and physical characteristics given in the table were conservative, and that independent tests had always confirmed them or exceeded them. Mr. Townsend said that the paper showed the characteristics of steel were improving more and more, and that the founders were thus faced with new problems that would have to be solved if the manufacture of castings were to keep up with the progress of the metal.

Dr. Andrew suggested that a steel casting suitably heat-treated should be as good as a forging. He emphasized the importance of the initial structure of the metal on future results. He referred to vacuum pouring and said that he had experienced disappearance of oxygen with a lowering of the tensile strength. Mr. Mercer suggested that the fluidity of a low-carbon steel could be almost as good as that of a higher-carbon steel if the metal were watched in the furnace.

In replying, Dr. Hatfield said that there always will be cases where, under certain conditions, forgings must be sounder than castings. He agreed that the presence of gases in the metal is necessary to obtain the best results.

The next two papers were presented together; they were: "Suggestions for Research on Steel Castings," by Prof. J. H. Andrew, dean of the faculty of metallurgy, University of Sheffield, and "A Note on the Influence of Temperature Gradients in the Production of Steel Castings," the American exchange paper, by George A. Batty. As sufficient time was not left to permit of adequate discussion on these important subjects, it was decided that discussion should take place by correspondence. The next paper was: "Castings," by W. Machin and M. C. Oldham, Vickers-Armstrongs, Ltd., Barrow-in-Furness.

During another session which was

held concurrently wtih the symposium on steel foundry practice, the following papers were presented: "The Making of Large Castings By Loam Moulding," the French exchange paper, by Henri Fabre and H. Dubois, Societe des Etablissements Bracq-Laurent; "German Iron Foundry Progress in Piston Rings, Brake Drums and Other Automobile Castings," by William A. Geisler, of Alfred Teves, Maschinen-und Armaturenfabrik, G.m.b.H., Frankfurt, Germany, presented on behalf of the German foundry association.

Favor Centrifugal Rings

In discussing the latter paper, T. R. Twigger said that in comparing single cast rings with centrifugal castings it must be agreed that the former were satisfactory in general service, but for high efficiency and severe duty centrifugal castings were superior. There were also considerable difficulties in the production of individual rings in the smaller sizes. He was impressed by the author's work on resistance to setting at working temperatures, and the results of his own experiments confirmed the author's work. Closing in and loss of pressure could be serious in high-duty engines, and it was difficult to lay down the factors responsible, although they were probably connected with creep phenomena. Mr. Geisler had employed some very sound practical methods of testing in this connection. The factors involved included radial pressure, temperature and time, but it was not easy to devise a formula. Creep occurred over a comparatively long period of time, and equilibrium was not obtained for quite a few hours. He was interested to note that rings formed by heat-shaping were better in this respect.

In reply, Mr. Geisler confirmed that very narrow rings were easier to produce as centrifugal castings, while larger rings could be produced more cheaply by this method, but were not so satisfactory in service. Very small rings were also difficult to machine when individually cast. He had not had much experience with heat-treated rings and was, in fact, only just starting to use hardened rings.

G. L. Harbach, of Worthington-Simpson, Ltd., Newark, presented a paper on "Relationship in Cast Iron Test Results." J. G. Pearce said that, other factors being equal, a round bar is stronger than a square bar, and this is due to the difference in the section. He pointed out that transverse test bars that have been machined improve test results. P. A. Russell spoke in favor of the transverse rupture test. During the discussion, in which John Shaw took part, some difference of opinion was expressed as regards the dimensions of test bars and the tensile-transverse ratio developed up to the present.

During the meeting a number of visits were arranged through the courtesy of the leading steelworks of Sheffield. An interesting ladies' program was arranged, and about 400 people assembled for the successful banquet on the Wednesday evening.

Patterns Marked By One of Four Methods

Patterns are marked according to any one of four methods: 1—The number is painted on a space left for that purpose. 2—The numbers are stamped with steel or cast iron stamps driven into the face of the pattern with a hammer. 3—The group of figures is formed on a thin strip of metal in a small press. The piece of metal then is attached to the pattern. 4—Individual letters and numbers in a wide variety of sizes, styles and metals are attached to the pattern, either with shellac, small prongs on the letters, or by small nails driven through them.

The first two methods are employed principally for pattern identification and record. The impression does not appear on the casting. Either of the other two methods is perfectly satisfactory so far as leaving an impression on the casting is concerned. Preference for one method over the other, largely is a matter of personal taste. Some men favor a uniform size and style of letters on all patterns. Others lean to a variety of sizes and types of letters on different sizes and shapes of patterns. Relative cost of the two methods depends on the volume of production.

Book Review

Transactions of the American Mining and Metallurgical Engineers, Iron and Steel Division, 1934, published by the Institute and supplied by THE FOUNDRY, Cleveland, for $5.00 plus 15 cents postage and in Europe by the Penton Publishing Co. Ltd., London.

Papers presented at the fall meeting in Detroit in October, 1933, and at the annual meeting in New York in February 1934, and which in the opinion of the papers and publications committees merit a permanent place in the Institute's Transactions, are presented in this volume. The material includes the Howe Memorial Lecture by Dr. F. N. Speller on "Corrosion Problem with Respect to Iron and Steel."

E. B. Packard Co., 30 Church street, New York, has been appointed representative of the Standard Engineering Co., Detroit, for its line of refractory cements and allied refractories.

Maton Re-elected By Connecticut Group

W. J. Maton, Waterbury Farrel Foundry & Machine Co., Waterbury, Conn., was re-elected president of the Connecticut Foundrymen's association at the annual meeting, Home club, Meriden, Conn., June 21. Other officers are: B. W. Spencer, Connecticut Foundry Co., Rocky Hill, Conn., vice president; G. R. Holmes, McLagon Foundry, Co., New Haven, treasurer; N. J. Stringer, Charles Parker Co., Meriden, secretary. The board of directors includes the above named officers and the following: C. S. Neumann, Union Mfg. Co., New Britain, Conn.; C. S. Parker, Charles Parker Co., Meriden; J. D. Coltman, Bullard Machine Tool Co., Bridgeport; H. S. Washburn, Plainville Castings Co., Plainville, Conn., and E. B. Spencer, Philbrook-Booth & Spencer Co., Hartford.

What NRA Cost Industry and Government

National industrial conference board, announcing the results of an investigation of NRA and its 578 codes, states that the 2-year period of experimentation cost more than $93,000,000. This cost is distributed as follows:

Code Authority expenditures	$71,704,406
National Recovery Administration	18,110,091
Interior department, Administration of Petroleum code	2,214,963
Agricultural Adjustment Administration, Code administration	565,646
National Labor Relations board	1,214,489
National Steel Labor Relations board	25,000
Textile Labor Relations board	50,000
Total	$93,884,595

It is interesting to observe that these costs do not include the expense of code preparations, the individual expense of members of industry attending hearings, litigations in prosecution or defense of compliance measures, or does its total include the time of business men devoted to this major activity nor the increase in manufacturing costs.

The observation is made that budgets and expenditures over the second period of administration were markedly increased.

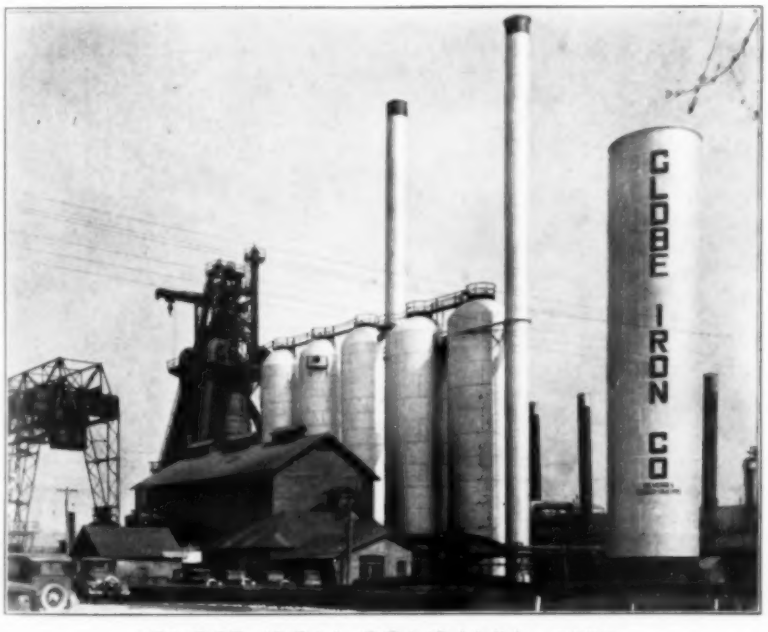
Forms Italian Firm

Norton Co., Worcester, Mass., has formed an Italian Norton Co., for manufacturing grinding wheels and abrasive articles in Italy. The Societa Anonima Produzione Mole Abrasive Richard Ginori, is associated with the Norton Co. in this new organization.

67 Years *of Continuous* PROGRESS
1868 ★ 1935

Customers who tried Globe Silvery from this furnace → as a "Medicine" Iron are today using as a standard part of their mix Globe Silvery made in this furnace. ↓

GLOBE IRON COMPANY—1900



GLOBE IRON COMPANY—1935

★

THE MARCH OF GLOBE SILVERY

1868
OLD FULTON FURNACE
40 feet high — 4 ft. hearth
capacity 10 tons daily

1872
OLD GLOBE FURNACE
Warm blast — 46 ft. high
6 ft. hearth — 15 tons daily

1903
NEW GLOBE FURNACE
Hot blast — 76 ft. high
9 ft. hearth — 100 tons daily

1912
NEW GLOBE REBUILT
76 ft. high — 10½ ft. hearth
capacity 120 tons daily

1932
LATEST GLOBE FURNACE
87½ ft. high — 14½ ft. hearth
capacity 250 tons daily

• • •

GLOBE IRON COMPANY
JACKSON, OHIO

ORIGINATORS OF SILVERY PIG IRON

Ford Opens Canadian Foundry

(*Continued from page* 45)

individual thicknesses, but uniform in outside dimensions, is built up successively from the bottom. Short pieces of cylindrical cores dropped into suitable openings after the manner of flask pins, locate each core in relation to the core immediately below. The top of the fifteenth core is covered with a sheet of paper and then the sixteenth core containing the runner basin and riser openings is set in place. The hinged cover plate is lowered, the bolts are adjusted and the nuts tightened with a special socket wrench.

Metal from the basin enters a 4-inch diameter center sprue which extends approximately half way to the bottom of the core stack. A large chamber at the bottom of the sprue is connected to each of the four mold cavities by a single short gate. Small passages near the bottom and top serve to equalize the rise of metal in each of the four castings and also serve as tie bars to maintain the group in a rigid position until the castings reach the shakeout station. The ladle holds approximately 1200 pounds of metal, enough to pour two molds with a little to spare.

Melts Cold Stock

The electric furnace in which the metal is melted from cold stock is mounted at a sufficient height above the floor to permit filling the ladle at approximately the proper height to pour the molds. This reduces the amount of hoisting and lowering required on the chain block by which the ladle is suspended from the monorail. The furnace built by the Swindell-Dressler Corp., Pittsburgh, utilizes three 10-inch electrodes and is equipped with a removable top which is swung to one side to facilitate charging.

Anticipated analysis of the metal in the casting is: Carbon 1.35 to 1.60 per cent, manganese 0.60 to 0.80 per cent, silicon 0.85 to 1.10 per cent, chromium 0.40 to 0.50 per cent, copper 1.50 to 2.00 per cent, phosphorus 0.10 per cent maximum, sulphur 0.06 per cent maximum. The charge is made up of 35 per cent steel scrap and the remainder pig iron, return scrap and alloys. The steel scrap coming from various parts of the company's plant is classified carefully in suitable containers. With an accurate knowledge of the composition of this miscellaneous material, no trouble is experienced in making up a charge that will melt down to the required analysis.

The charge is made up in a pan mounted on a scale car. The metallurgist estimates the amount of the different ingredients available and

Limits on Test Bar

	Max.	Min.
Elastic limit, p. s. i.	91,000	93,500
Tensile strength, p. s. i.	108,000	107,000
Elongation, per cent	1.50	2.00
Reduction in area, per cent	2.00	2.50
Brinell	255	269
Transverse breaking, lb.	9,565	9,330
Deflection, in.	0.420	0.430

posts a card with the necessary instructions on the face of the scale. The helpers load the pan according to the instructions while the scale registers the amount. The scale car, taking power through a shoe on a third rail on the side of the stock bin, moves forward to a point where the charging bucket rests in a pit in the floor. Tilting mechanism on the car lifts the back end of the pan and the charge falls into the bucket. The bucket then is picked up by the crane and lowered through the open top of the furnace. A latch is released in the bottom and the charge rests on the bottom of the furnace when the bucket is removed. The bucket bottom then is relatched and the bucket is returned to the pit to be reloaded for the following heat.

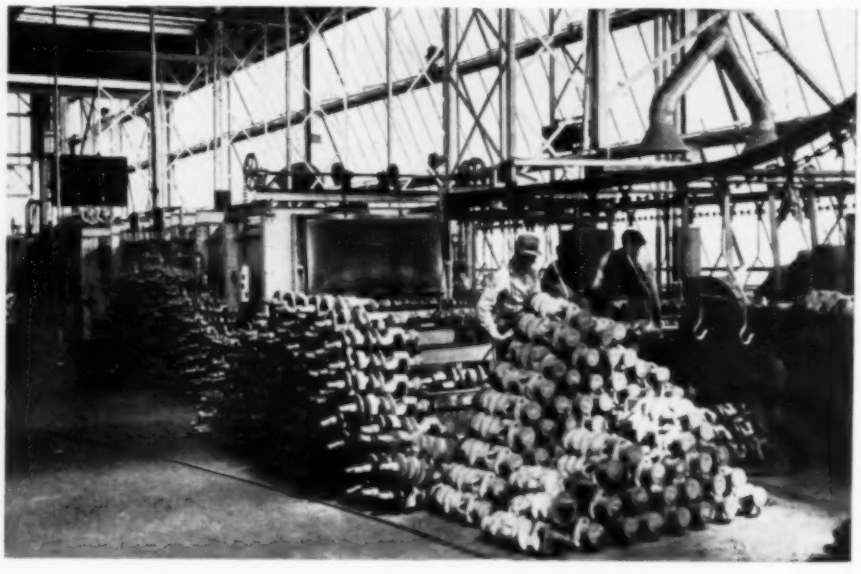
After the metal is poured into the molds the conveyor carries the molds around a U-turn and into a long hooded chamber extending from end to end over the second leg of the conveyor unit. Here the castings are allowed to cool for 4 hours after which men armed with long steel bars knock the sand away from the castings. The men stand on the outside of the chamber and work through a number of narrow openings. All the sand falls through a grating and on to a wide belt which discharges into trucks or railroad cars outside the building. It is claimed that any saving effected by reclamation does not warrant the expense entailed in the process.

Each cluster of four castings is laid on the floor where the castings first are broken away from the gates. Each casting then is placed temporarily in a rubber cradle which supports it at all points except under the riser. The riser then is knocked off with a sharp blow from a sledge hammer. In the cast condition the metal is hard and brittle, but becomes exceedingly tough and strong after a suitable heat treatment. Brinell reading of the castings before heat treatment is 340 to 360. After the heat treatment the average reading is 360, and what may be regarded as more remarkable, the hardness is uniform from the outside to the center.

Castings Are Inspected

The castings are hung on a waist high conveyor where they are ground with portable tools and inspected. Beyond this point the conveyor moves upward and passes through a sand-blast chamber and then descends to the level of the heat treating furnace where the castings are removed from the conveyor and loaded on the apron of the furnace. The heat treatment is automatic and continuous. The furnace, 62 feet in length and heated with gas, imparts a double heat treatment to the castings. In the first the castings are raised to a temperature of 1650 degrees Fahr., in about an hour and held at that soaking temperature for 20 minutes. They then pass through a cooling zone where

(*Concluded on page* 89)



Castings are carried automatically through a long furnace where they are subjected to a double heat treatment

ADVERTISING PAGES REMOVED

(*Concluded from page* 86)

the temperature drops to 1000 degrees Fahr. In the following 45 minutes the castings are raised to a temperature of 1400 degrees and allowed to soak for 1 hour. Then for a period of 1 hour they are cooled down to a temperature of approximately 1000 degrees at the rate of 100 degrees Fahr. per hour and then air cooled to atmospheric temperature before removal from the furnace.

The treated castings are hung on a conveyor which carries them through a second sandblast chamber and thence to a station where they are inspected, ground and otherwise finished before shipment to the machine shop. Sandblast chambers were supplied by the W. W. Sly Mfg. Co., Cleveland and the Pangborn Corp., Hagerstown, Md.

Tests on the physical properties of these castings include an impact test where a 50-pound weight is dropped a distance of 40 inches on the flange of the center main bearing, and a torque test where the casting is subjected to a twisting pressure of 45,600 pounds. The first torque test is applied after the casting has been rough machined. The second in the opposite direction is applied to the finished crankshaft. Other physical properties are tested as shown in the accompanying table.

Dirt on Windows Causes Loss of Daylight

That an applied scientific study of daylight can reduce both operating and overhead costs probably receives recognition by comparatively few foundry managers. Yet, an increase in speed and accuracy of vision and a decrease of fatigue coincident with better lighting obviously would step down the operating expense, whereas the proper use of daylight in place of electricity would mean a decided reduction in overhead. Feeling the need for such a study, the department of engineering research of the Detroit Steel Products Co., Detroit, collaborated with the department of engineering research of the University of Michigan in laboratory work and field survey, the results of which are available in pamphlet form.

One of these brochures, published by the Detroit Steel Products Co., and entitled, "Industrial Daylighting by the Fenestra Method" devotes several pages to a discussion of the coating of dirt on factory windows as the most serious factor in preventing daylight from working for the industry. The windows of the average manufacturing plant, they point out, are washed but twice a year, often being cleaned in the spring when the light is greatest rather than in the winter when dark days would seem to call for every possible means of increasing light penetration.

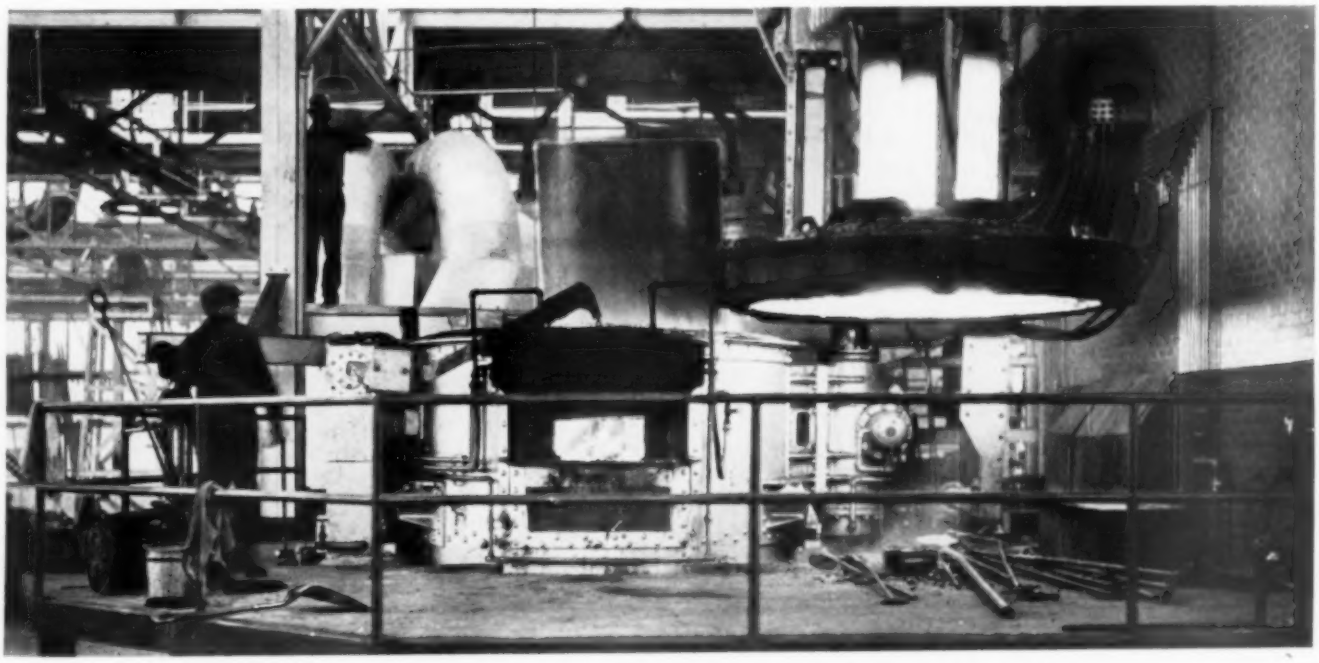
Studies reveal that the six months' accumulation of dirt causes vertical windows to lose 50 per cent of their efficiency, the windows sloping 30 degrees to lose 75 per cent, and windows on a slope of 60 degrees, such as the average skylight, to lose 83 per cent. They find further that the accumulation of dirt is about 75 per cent on the inside and 25 per cent on the outside, probably due to the occasional wash by the rain, a fact which suggests the use of the rough side of the glass on the outside and the easier to clean smooth surface on the inside.

Rough or hammered glass is much easier to clean than the vertically or horizontally ribbed glass. Likewise, by reason of the ease in cleaning, the monitor and the saw-teeth type of head lighting is preferable to the skylight. Many monitors can be cleaned inside by a man standing on the roof, whereas the horizontal skylight serving as a catch-all for the descending soot outside and the ascending smoke inside, can be washed only by an acrobatic feat on the top of ladders, which require a considerable expenditure. Skylights have been found to transmit as little as 1 per cent daylight, whereas vertical glass in the monitor loses only 50 per cent. To reduce the glare as well as the heat in the summer months, a coat of whitewash or other solution may be sprayed on the glass and washed off in the fall.

Book Review

Trademarks in the Refractory Industry and in Furnace Construction (Markenbezeichnungen im Feuerfest-Fach und im Ofenbau), by L. Litinsky, paper, 93 pages, 5¾ x 8½ inches, published by Verlag L. Litinsky, Leipzig, Germany, and supplied by THE FOUNDRY, Cleveland.

This handy little volume published in German, contains about 1500 well known trademarks relating to refractory materials and industrial furnaces. The various names are listed alphabetically with the names of the producers, their addresses, and in most cases, the type of material. The majority of the trademarks listed are European, but some of those familiar in the United States and Canada are included. The book includes four appendices on various subjects.



The furnace is charged through the top while the cover is swung to one side

A Glimpse of the 1950 Foundry

(*Continued from page 47*)

ment will be in use. Floors and gangways will not be swept by the present broom method, but permanently installed vacuum systems will keep all departments free from dirt and dust. Automatically operated lighting units controlled by photo-electric cells, and a great many other devices to eliminate the variables involved in the human element, will add to manufacturing efficiency.

Waste, such as cupola heat loss up the stack, sand, refractories, indirect supplies, and especially unnecessary cleaning operations in castings, will have been cut to a minimum by new equipment and a better understanding of the physical and chemical reactions of the materials and combinations of materials entering into the operations and processes.

Raw materials, fuels, fluxes, refractories and certain of the indirect supplies will have new specifications and characteristics with a resulting better understanding between supplier and consumer. For example, the pig irons and all of the virgin metallic alloys and their inherent nonmetallics will be controlled definitely by the spectroscope, the x-ray, high power microscopes and electro analysis. We will have proven by 1950 that the physical properties of cast metals are not primarily controlled by the five principal metalloids, namely carbon, silicon, sulphur, phosphorus, and manganese as at present, but that the nonmetallics and the traces of other elements and their combinations are the essential factors in our control of desired properties.

Alloys, such as chromium, nickel, molybdenum, etc. are bound to become better understood by 1950 than at present. I do not think that it is too bold to make the prophecy that the foundryman who does not become alloy-minded will be nonexistent as far as the successful foundry of 1950 is concerned.

The virtues of alloy cast irons versus other structural materials for definite applications scarcely have been touched upon. I refer to the vibration damping effect or *dynamic ductility* as expressed by von Heydekampf in particular. Other virtues are fatigue properties, freedom from *notch effect*, corrosion and heat resistance, and resistance to thermal shock. All of these features will have been established definitely in the higher alloy compositions during the next 15 years.

How will we be melting or processing these alloys in 1950? I believe the cupola will continue to maintain its prominence, especially the cupola of 1950. There will be radical changes in that type of melting unit as we more intelligently understand what really takes place within its various zones and knowledge develops with respect to the five things that enter into its operation, namely refractories, fuels, fluxes, metals and air. To understand more thoroughly what has taken place within the cupola, we must study not only the product sought, but the by-products developed in the process. There are two by-products, namely gases and slags, both of which will be considered as important in successful operation as the materials charged.

Rapid Melting Cupola

I can vizualize the cupola of 1950 melting at twice the present rates per hour, the size remaining the same. Higher efficiencies will be secured through several changes in construction, such as water cooling the high temperature zones, improved refractories and tuyere designs. By processing the air supply such as drying, preheating and possibly enriching the oxygen content, we will double the melting rates. Improved coke with respect to burning rate, ash condition, sizing, etc. will also have a great influence not only in increasing the efficiency and capacity but also in controlling the carbon content and quality. My guess is that we will operate a cupola more along the lines of a blast furnace over long periods of time without the daily dropping of the bottom and necessary repairs.

The electric furnaces as in use today, both the indirect and the direct arc types, will continue to find new applications not only for cold melting and duplexing, but for triplexing and as a means of maintaining uniformly high temperatures where a continuous uninterrupted supply of molten iron is necessary. In addition to the type mentioned, the induction type will have established itself in the 1950 foundry.

Powdered coal fired furnaces, air furnaces and crucible furnaces will have established themselves for definite applications.

There is one refining unit, the Bessemer converter which unquestionably will find its way into the gray iron foundry by 1950. At that time we will be triplexing large quantities of metal, from the cupola into the bessemer, and then into the electric furnace where the necessary alloying and superheating will be completed.

In the molding division of the 1950 foundry, we may expect even more changes than have taken place during the last 20 years. Synthetic refractories and binders and the technical control of their properties will be a certainty. With that control established, new methods of sand handling and molding will follow. Closed conveying systems from the conditioning units to the mold blowing machines is one possibility for the 1950 foundry. Mathematical formulas for venting, gating, mold hardness and pouring temperatures will be available to the foundry executive. The same is true with respect to coremaking methods and core sand mixtures. New developments in core binders, possibly air drying, will eliminate expensive equipment for drying and handling.

In laying out the progressive system for the 1950 foundry, one must keep in mind the ideal working conditions for the laborer. Consequently, after the mold properly is fitted with cores and is ready for pouring, it will be conveyed into a separate pouring and cooling room where adequate ventilation and air conditioning are provided. After cooling, it will pass on to the shakeout and then to the cleaning rooms.

The cleaning of castings made in the 1950 foundry should be comparatively easy. There will be no reason for sand burning in where properly prepared refractories are used as previously mentioned. Excessive grinding due to swells, fins, cutting, etc. should be a thing of the past.

In addition to foundries employing the ordinary methods of molding, there will be a wider application of the new methods of molding, as follows:

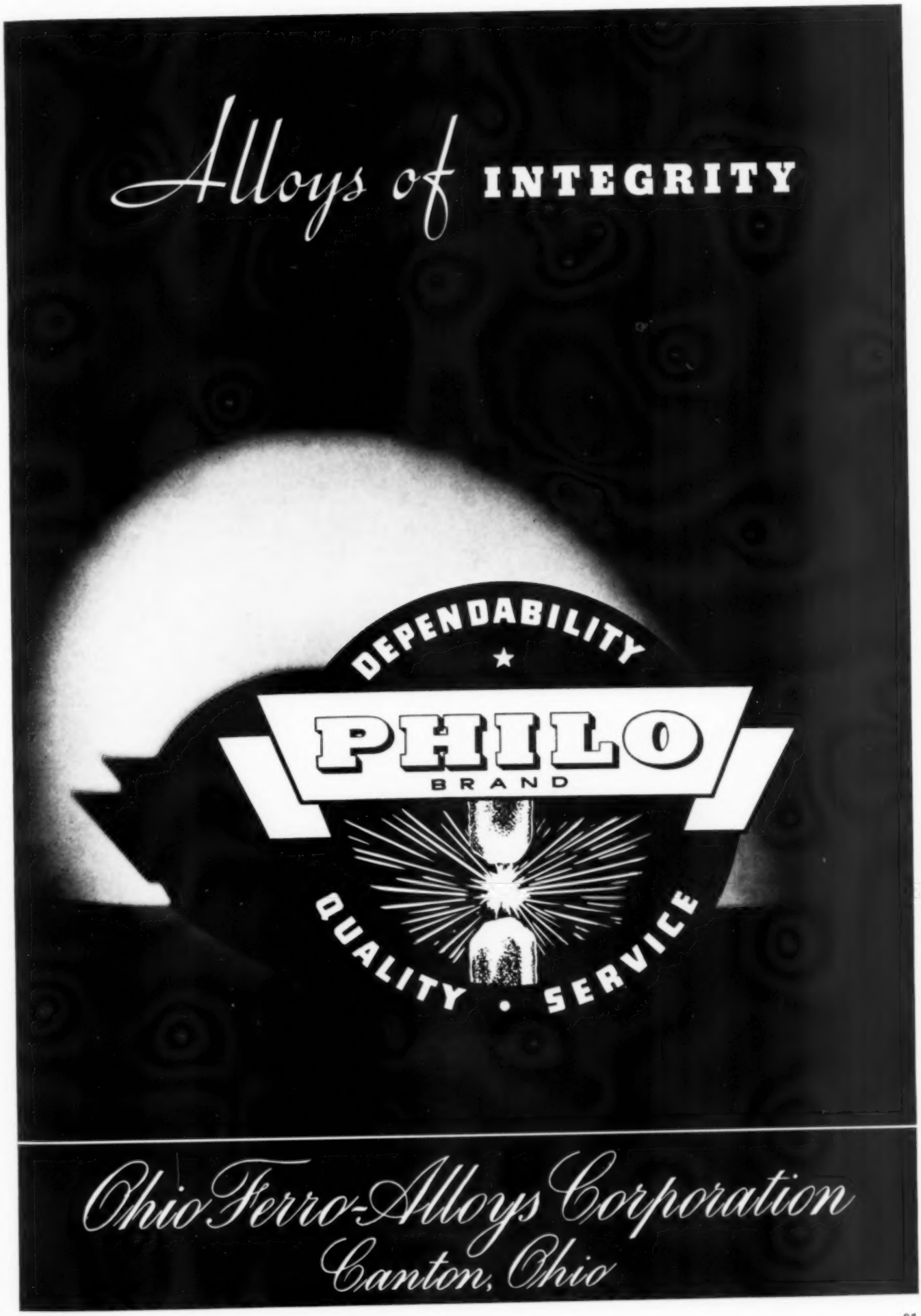
Permanent or metal mold process
Centrifugal casting process
Pressure casting process

Permanent molding will have developed by 1950 to an extent where complicated castings, which have undreamed of properties, will be made by that method. By the use of alloys, by taking advantage of the self-forging effect and by solidification rate control, castings with closer mechanical tolerances and physical properties than at present, will be produced. The centrifugal and pressure methods also will be used more extensively. Alloys which do not lend themselves readily to sand casting will be made by these methods, facilitated by controlled atmospheres within the molds.

Hit and miss methods of heat treating castings as practiced today will have advanced to a science controlled by technically trained men. I look for real developments beginning with the very moment that a mold is filled with molten metal and progressing with the casting into the finished product. By 1950 directional solidification will be a reality. There will be special applications of the induction hardening methods, and other localized treatments to develop special properties will be common practice. The long cycle malleabilizing operations will have been reduced.

A discussion of the foundry of 1950 would not be complete unless we also express our conceptions of the found-

(*Concluded on page 92*)


Alloys of INTEGRITY
DEPENDABILITY
PHILO
BRAND
QUALITY • SERVICE
Ohio Ferro-Alloys Corporation
Canton, Ohio

(*Concluded from page* 90)

ryman himself. It is apparent that a good foundry executive will require a thorough knowledge of chemistry and physics, or perhaps better still physical chemistry. Our colleges at present and more so in the future will be required to prepare men to fill these positions. In the past, and at present, the foundry has been frowned upon by graduates as a undesirable place to work. By 1950 this illusion will have disappeared and the technical man will realize that there is as much, if not more, science involved in producing good castings than in any other single branch of industry.

In conclusion, I would like to picture the foundry of 1950 as an institution or an industry wherein science will play an important part along with experience, and that the continued efforts of large research groups and colleges will be the beacons to guide us in attaining our present conceptions of the ideal foundry 15 years hence.

Obituary

WILLIAM FRANCIS, 67, president, Francis & Nygren Foundry Co., Chicago, died at his home in Chicago, July 21. Mr. Francis was born in Ackley, Iowa, and went to Chicago as a young man, entering the employ of a foundry there. In 1898 the company bearing his name was incorporated, and since that time he had served as its president. Mr. Francis was active in Chicago civic affairs, was one of the founders of the Chicago Association of Commerce and for several years was president of the Chicago Young Men's Christian association.

* * *

J. F. Newman, 55, president, Lawrenceville Bronze Co., Pittsburgh, died in that city, July 15.

* * *

Homer D. Coleman, 60, president of the Consolidated Brass Co., Detroit, died recently at his home.

* * *

W. H. Stackhouse, 70, for 35 years a partner and general manager, French & Hecht, Springfield, O., died in Cleveland, July 4.

* * *

Henry Hartwig, Struthers-Wells-Titusville Corp., Titusville, Pa. died at his home in that city July 19, aged 72 years.

* * *

Albert C. Lehman, 56, chairman of the board of Blaw-Knox Co., Blawnox, Pa., and founder of its original unit, died in Pittsburgh, July 24. He was noted for his activity in civic affairs and philanthropies. He was born in Pittsburgh, Oct. 14, 1878, and after education at Harvard university, organized the Blaw Collapsible Steel Centering Co., original unit of Blaw-Knox. He served the company first as vice president and later as president, continuing in that capacity until late 1934, when he was elected chairman of the board. Besides his position as director of Blaw-Knox, he was also on the board of a number of subsidiary and affiliated companies—the Lewis Foundry & Machine Co., Pittsburgh Rolls Corp., Union Steel Castings Co., National Alloy Steel Co., Blaw-Knox International Corp., and Blaw-Knox Ltd.

* * *

William F. Calkins, 80, for 30 years owner and operator of the Traverse City Iron Works, Traverse City, Mich., died July 12 in Marshall, Mich.

* * *

A. W. Gilbert, 83, retired foundry superintendent, Belleville, Ill., died recently. Mr. Gilbert was the oldest foundry worker in Belleville and was active in the industry until 3 years ago when he retired. He was foundry superintendent at the Harrison Machine Works for 50 years and when that plant sold its buildings, he continued on as superintendent at the Excelsior foundry.

* * *

Erick E. Lindgren, 66, president, Lindgren Foundry Co., Batavia, Ill., died June 18. Mr. Lindgren was born in Sweden, March 26, 1869 and came to this country at the age of 12, settling in Chicago. As a young man he worked for William Nygren of Chicago, and in 1909 he founded the Semi-Steel Test Foundry, Chicago, which specialized in producing test castings for ice machinery. He later disposed of his interests and in 1915 became connected with the Frick Co., Waynesboro, Pa. He moved to Batavia, Ill. in 1920 and established the Lindgren Foundry Co. Mr. Lindgren was a member of the American Foundrymen's association, Swedish Engineers' society and other organizations.

Use Aluminum Castings

Aluminum has been used extensively in decorating the new Oriental Art museum in Seattle. Two fountains, weighing about 1100 pounds, and made of cast aluminum, stand in front of the building. The main entrance is entirely of aluminum, including the doors, grilles and sash. All display cases in the museum are made of aluminum.

Westinghouse Electric & Mfg. Co. is employing sodium vapor lighting in its factory yards in Trenton, N. J., and at the main plant at Bloomfield, N. J.

Several Methods for Casting Iron Balls

Several methods are available for casting large solid cast iron balls. The method adopted in any given instance will depend to some extent on the number to be cast and to some extent on the purpose for which the castings are constructed. In all instances the mold is split vertically instead of horizontally and is heated before the first iron is poured into it to expel all moisture.

In one method the mold is provided with a large riser and is fed with a rod in the ordinary manner. In a second method a smaller ball is placed in the mold to provide a thickness of 1 or 2 inches of metal. The inner ball is provided with small prongs or projections to hold it.

In a third method the mold is equipped with a pair of trunnions and is revolved for a few minutes after the metal has been poured into it through a comparatively small gate. The actual time will have to be determined by experiment.

Book Review

Research, by T. A. Boyd, cloth, 319 pages, published by D. Appleton-Century Co., New York, and supplied by THE FOUNDRY, Cleveland for $2.50 plus 15 cents postage and in Europe by the Penton Publishing Co. Ltd., London.

Research, which consists essentially of experimentation under conditions that are carefully controlled, provides a major factor in the establishment of new industries and in the development of those in existence. This interesting volume, prepared by one actively associated for a number of years with industrial research, points to various undertakings which may be classified as research.

In the second part of the book, the author discusses the evolution of research, and how it is organized and applied in the industrial world. This is followed by a section on the human side of research, the qualifications, recruiting, training and remuneration of the specialist needed to undertake a kind of exploration in the research laboratory.

The book should provide an inspiration to the young man desirous of training himself to enter some field of industrial research. It also should prove a guide to those industrialists seeking further information on the benefits and methods of conducting industrial research.

Hydraulic Press Mfg. Co., Mount Gilead, O., recently has opened a Detroit sales office in the Curtis building, 2842 West Grand boulevard. Reider Thoreson is in charge.

ADVERTISING PAGES REMOVED

European Foundry Practice

Digest of recent literature covering various phases of castings manufacture

Steel Castings Defects

Remarks on Certain Difficulties Encountered in the Manufacture of Steel Castings. (Considerations sur Certaines Difficultes Recontrees dans la Fabrication des Pieces en Acier Moule), by G. Delbart. *Bulletin de l'Association Technique de Fonderie*, Paris, December, 1934.

The best way to avoid blowholes is to control the final stages of the melting of the steel and to add ferrosilicon, aluminum or other additions that tend to calm the metal. Even then, blowholes may appear, due to the dissolution of gases in the super-heated bath. To avoid this, the temperature should be under control constantly. The quantity of calming medium added should be measured and for heavy steel castings a smaller quantity should be used.

The author does not deal with microscopic inclusions. Inclusions are generally due to an erosion of the mold, the principal factors being: (1) nature of the mold; (2) nature of the metal, and more especially its viscosity; (3) pouring temperature; (4) design of the gates. Certain inclusions have a vitreous aspect and contain an appreciable quantity of manganese oxide. To avoid such inclusions, Maurer recommends the use of high quality refractories and investigations toward special melting processes.

The author has found these inclusions always contain manganese oxide; they only contain small amounts of aluminum oxide; often there is no lime, or only traces; the chemical composition of these inclusions is similar to that of inclusions due to erosion of the mold; in certain cases the inclusions contain more aluminum oxide, but less manganese oxide. The author expresses the opinion that the pouring temperature and the rate of pouring have a bearing on the subject. Pouring temperature should be neither too low nor too high, and, if possible, contained within limits not extending 20 degrees Cent.

According to W. Briggs and R. A. Gezelius, cracks are due to:—contraction of the metal during cooling; resistance of the mold to contraction stresses in the metal; insufficient physical properties of the steel at certain temperatures; the position of piping cavities. These authors distinguish two kinds of cracks—internal and external.

Principal remedies against cracks are: Preparation of molds that are not too rigid; use of properly-placed chills; use of ribs on large areas and providing for gradual passage from thin to thick sections; to pour the metal at a temperature that is not too high; on occasions, to use warmed molds; immediate removal of cores and other obstructions to contraction; proper position of gates and runners; control of preparation and chemical composition of the steel.

General soundness of a steel casting depends to a large extent on the castability of the steel, the factors of which are: Pouring temperature; chemical composition of the metal; state of the surface of the mold; humidity in the mold; temperature of the mold; permeability of the materials constituting the mold; height from which the metal is poured.

Generally speaking, successful steel castings depend upon the following factors:—Study of the shape and design of the casting, in which the designer and the founder should collaborate; study of the preparation of the steel, and finding the steel most appropriate for the casting; study of the patterns, molds and cores; study of the defects which are specific to foundry practice, and finding the causes and remedies; study of the most effective heat-treatment in each case.

High Temperature

Study of the Mechanical Strength of Chromium Cast-Iron at High Temperature, (Etude de la Resistance Mecanique a Haute Temperature des Fontes Refractaires au Chrome) by Ernest Morlet. *La Fonte*, bulletin of the French bureau of foundry research, Paris, March, 1935.

Experiments were made with an iron containing from 0.7 to 1 per cent chromium which was used for making castings having a tensile strength of not less than 7100 pounds per square inch at a temperature of 600 degrees Cent. The chromium was added to a high-duty pearlitic cast-iron made in the cupola. The composition of this iron was: Total carbon, 3.30 to 3.50 per cent; silicon, 1.50 to 1.60 per cent; manganese, 0.60 to 0.80 per cent; phosphorus, 0.20 to 0.30 per cent; sulphur, under 0.10 per cent. The chromium was added in the ladle, and the alloy had the following composition: chromium, 51 per cent; silicon, 23 per cent; iron, 26 per cent. Test bars were specially prepared.

The various tests included chemical analyses, micrographic examination, and the use of the dilatometer. The dilatometric tests showed that the addition of about 0.7 per cent chromium stabilized the iron and reduced the importance of the alterations due to the iron being subjected to a high temperature during a certain period. For the mechanical tests, the usual transverse and shearing tests were made with bars at normal temperature, but at the high temperatures only the transverse tests were made. One method was to bring the test bar slowly to the temperature of the test and to break it after it had been subjected to that temperature for 15 minutes. The other method was to break the test bar after it had been heated for 8 hours at 600 degrees Cent. The results of the tests are tabulated, and they show a considerable increase in the mechanical characteristics due to the addition of a percentage of chromium ranging from 0.70 to 1 per cent. In the static transverse test performed on the cold test bar, the addition of 0.70 per cent chromium increased the strength by from 10 to 15 per cent, and a similar increase was found when the test bar was brought to a temperature of 300 degrees Cent.

In the static transverse test effected at 600 degrees Cent., after the test bar had been heated at that temperature for 8 hours, the cast-iron containing no chromium had its strength reduced by about 50 per cent in relation to the strength at normal temperature, but with iron containing 0.70 per cent chromium, the decrease in strength was only 35 per cent.

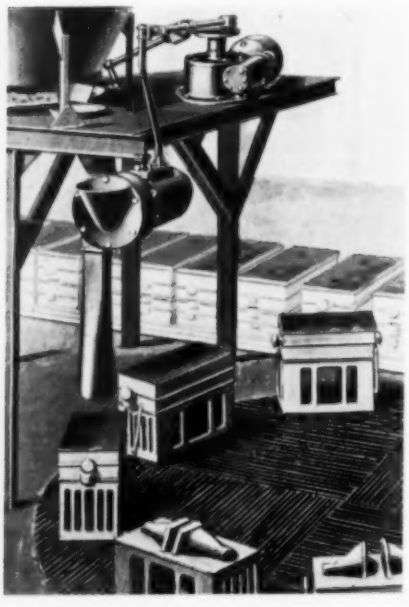
The results of the tests show that after having been heated for 8 hours at 600 degrees Cent., irons containing from 0.70 to 1 per cent chromium are about 45 per cent stronger than ordinary irons.

New Equipment

For Foundries

Sandslinger Unit Operates Automatically

Beardsley & Piper Co., 2541 North Keeler avenue, Chicago, has introduced a new sandslinger for production foundries which provides automatic molding. It is claimed that this unit requires no labor for the ramming operation, and that it provides complete mold density control, reduces floor space and flask requirements and lessens flask and pattern wear.



The ramming head is actuated mechanically by a robot

The unit consists of a swing type sandslinger mounted on a superstructure and fed by a suitable sand supply. The ramming head of the swing type unit is actuated mechanically by a robot which has an adjustable movement in any direction from a straight line to a full circle. The ramming unit, being suspended by a universal swivel joint at the top, rams over any predetermined area, handling with equal facility any size, depth or shape of flask.

Chain Coupling

Baldwin-Duckworth Chain Corp., Springfield, Mass., has introduced a new flexible chain coupling using special double-width roller chains. One strand of the chain is equipped with the standard cylindrical rollers, while the other strand has convex surface, oversize rollers to give free operation where shaft deflection and misalignment exist. It is claimed permanent shaft deflection up to three degrees can be handled without undue strain.

Designs Welding Torch for General Duty

A new welding torch, known as the Purox No. 35 general duty welding torch, recently has been introduced by the Linde Air Products Co., 30 East Forty-second street, New York. The unit is constructed of extruded brass, monel metal and drawn copper, and with silver soldered tubes. The torch is said to be rugged and capable of withstanding rough treatment.

The ribbed design of the extruded brass handle reinforces the torch and enables it to be gripped easily. The hexagonal socket arrangement permits the welding head to be assembled in the most convenient of six optional positions in relation to the body. The tips are of hard-drawn copper.

Planer Will Handle Material 24 Inches Wide

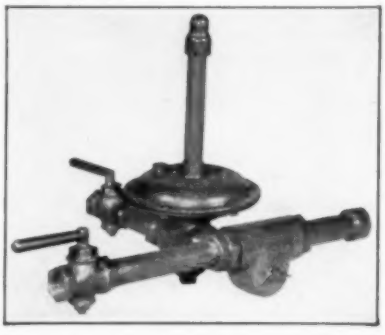
Oliver Machinery Co., Grand Rapids, Mich., has introduced a new single surface planer which will surface up to 24 inches wide and 8 inches thick, at any speed from 18 to 40 feet per minute. Pieces as short as 10½-inches will feed through one at a time.

A one piece base casting is said to insure rigidity and alignment of working parts. Revolving parts are enclosed to exclude dirt and reduce maintenance. Forced lubrication is used. Control is centralized at the left of the operator and the feed is governed by the dial indicator.

A heavily ribbed cast table carries the two table rolls, providing a fully enclosed cavity for the roll drive mechanism. A hand wheel serves to operate the two large elevating screws, through worm and gear. The cylinder or cutter head is driven by a 5 horsepower motor, while a 1 horsepower feed motor is separate.

Unit Mixes Air and Gas for Burner Control

Philadelphia Drying Machinery Co., 3351 Stokely street, Philadelphia, has introduced a proportional mixer for a gas burner which consists of a diaphragm-actuated control valve, known as a zero governor, which feeds gas at atmospheric pressure to an inspirator into which the gas is drawn and mixed with air. Since the gas enters at a constant pressure, the amount is directly proportional to the quantity of air flowing to the inspirator, causing the two to combine in constant, unvarying ratio, subject to manual regulation by a valve.



Gas and air combine in constant ratio, subject to manual regulation

Emergency Light

National Carbide Sales Corp., Lincoln building, New York, has introduced a new carbide emergency light weighing 40 pounds when fully charged, and which burns for 3 hours, giving 8000 candle power. The reflector is mounted on a universal swing joint, so that the light may be shifted to any angle and may be folded down for carrying by a convenient handle above the carbide hopper.

Standards for jig bushings, as approved by the American Standards association, recently has been published by the sponsor organizations, the Society of Automotive Engineers, the National Machine Tool Builders' association and the American Society of Mechanical Engineers.

PANGBORN-NORBIDE*

"LONG-WEAR" BLAST CLEANING NOZZLES

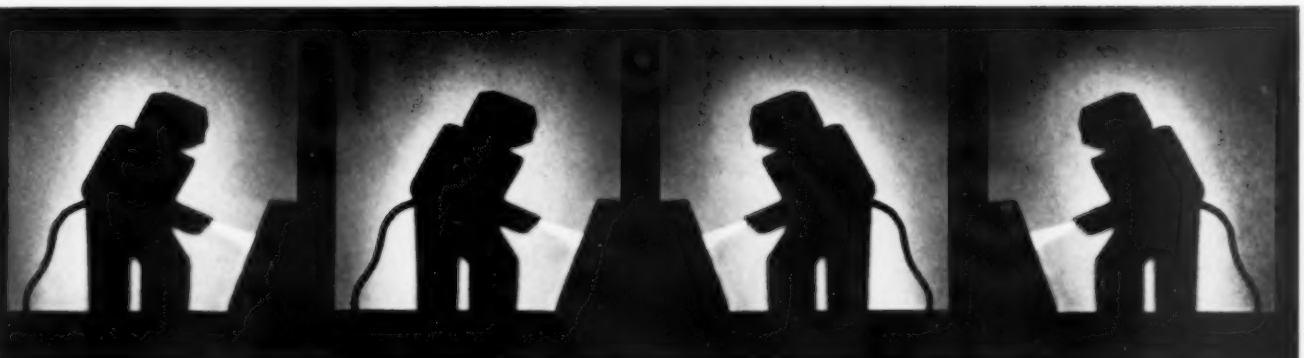
GUARANTEE
1500 hours service with steel abrasives—750 hours with sand.

★Trade-mark of Norton Co. for Boron Carbide

PANGBORN CORPORATION

The World's Largest Manufacturer of Blast Cleaning and Dust Collecting Equipment

HAGERSTOWN - - - - MARYLAND



"CERTIFIED" STEEL ABRASIVES

ALL blast cleaning jobs are done quickly, efficiently and with less dust when "CERTIFIED" Steel Abrasives are used . . . The World's Best Abrasives for all Blast Cleaning . . . As sharp as a diamond, as hard as a hammer. One ton will do the work of a carload of sand.

Let us demonstrate . . . write today.

PITTSBURGH CRUSHED STEEL CO.

PITTSBURGH, PENNA.

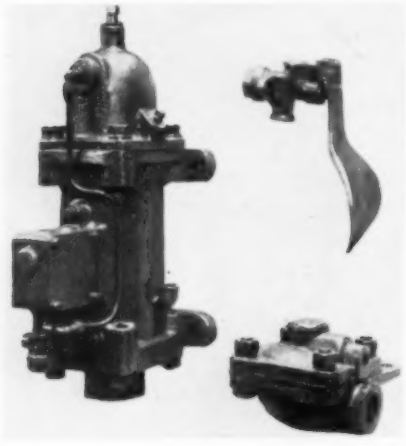
STEEL SHOT AND GRIT CO.

BOSTON, MASS.

Controls Number Of Jolts on Machine

Osborn Mfg. Co., 5401 Hamilton avenue, Cleveland has introduced a pneumatic jolt timer, which is designed to operate through a variation of from 25 to 30 pounds in pressure without variation in timing interval. A single adjustment is all that is necessary to obtain any particular time interval within the range of the timer. The unit is started by simply pressing the control lever, and no further attention is required until the timer has completed the jolting sequence and it is desired to start another.

The jolt timer consists of three separate parts, the timer, the diaphragm valve and the control valve, which may



The timer will operate through a wide variation in air pressure

be hand or knee operated. The diaphragm valve takes the place of the usual hand throttle valve and its opening and closing are controlled by the timing device, which in turn, is set in motion by the control valve. The device consists of a plunger operating in a cylinder, the plunger in its motion actuating two valves. One valve controls the pressure on the diaphragm valve and the other provides an automatic cut-off for the pressure which sets the timer in motion. When the operator presses the control valve lever, air from the main supply line enters the cylinder of the timing device, thus forcing the plunger to the bottom of the cylinder. As the plunger approaches the end of the stroke, it actuates a valve which shuts off the supply of air from the control valve, at the same time relieving pressure on the diaphragm valve and causing it to open. Immediately upon reaching the end of the down stroke, the plunger reverses direction and is forced by spring pressure to return to its normal position at a speed dependent on the adjustment of the needle valve. Just before the plunger comes to rest in the normal position, it again actuates the previously mentioned lever, reversing the operation by building a pressure on the diaphragm valve to shut it and at the same time, opening the air line from the control valve ready for the next operation.

It is claimed that the jolt timer has an accuracy of approximately 1.5 per cent or less and maintains that accuracy at intervals as high as 25 seconds.

Use Impregnating Process on Patterns

Pyratone Products Corp., 309 St. Johns court, Chicago, has introduced a process for treating wood, which uses a synthetic rosin of the phenol and formaldehyde condensation type. The product, when introduced or impregnated in wood, improves several of the characteristics of the wood, it is claimed.

In the process the wood is maintained in a vacuum and then submerged in the liquid rosin. Pressure of several atmospheres is introduced and the impregnated wood is then subjected to a cure at 200 degrees Fahr. for about 100 hours. Lacquer and varnishes may be applied readily to the surfaces of the impregnated wood.

It is claimed that the use of the process for wood patterns, which are to be given considerable use, serves to harden the surface and thus resist wear due to the abrasive action of the sand.

Unit May Be Used To Lift or Pull Loads

Yale & Towne Mfg. Co., Philadelphia, recently has introduced a new load handling device which may be used either in the horizontal or vertical po-

The device operated vertically or horizontally

sition. Used horizontally, it may be used to pull machines into position, moving materials, etc. Vertically, it is a hoist which lifts all types of loads up to the capacity of the particular lifting unit.

The unit is compact and portable. Moving parts are completely enclosed so that they may be operated in grease and protected from injury.

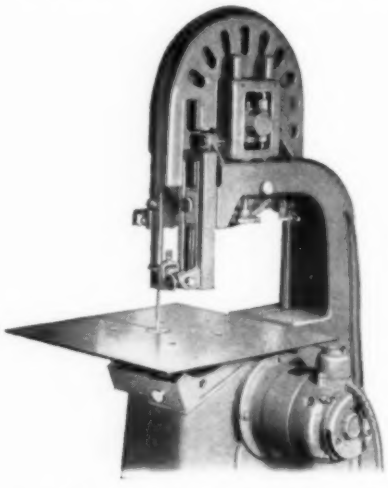
Laboratory Stirrer

Chemical Publishing Co., 175 Fifth avenue, New York, recently has introduced a laboratory stirrer. The unit is actuated by a shaded pole type motor and will run for a long period without damage. The motor is nonsparking and will not be injured by fumes and vapors. The speed may be varied as needed by a rheostat.

Speed of Wheel on Hand Saw Is Increased

J. D. Wallace & Co., 134 Soutn California avenue, Chicago, recently has made several changes in the design of its high speed 16-inch band saw. The wheel on the saw now is running at 1200 revolutions per minute, giving 5000 lineal feet of blade per minute. It is claimed that the high speed is obtained without sacrifice of wearing capacity of either machine or saw blades. This high speed is possible through careful construction and dynamic balancing of the band wheel.

A guard in the rear of the ma-

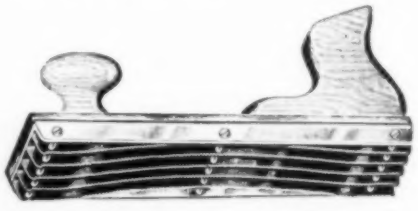


The wheel now runs at 1200 revolutions a minute

chine also is provided, and a light has been built immediately above the working area so that the light reflects on the work and does not shine in the operator's eyes.

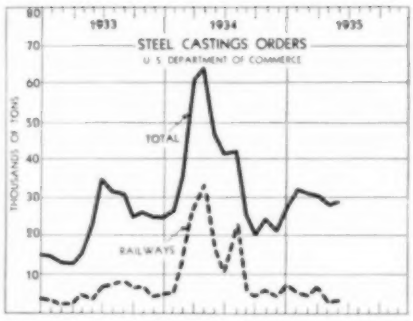
Surfacer Used for Castings and Patterns

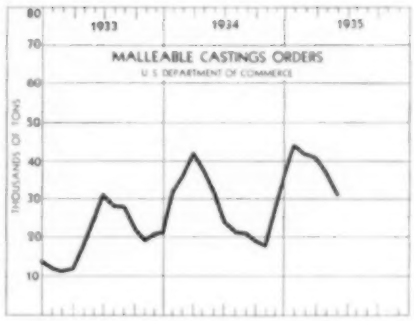
Surfacer Mfg. Co., 2452 Irving Park boulevard, Chicago, recently developed a hand surfacer which it claimed has wide application. In foundries, the surfacer, shown in the accompanying illustration, may be used for smoothing up aluminum, zinc, and other soft metal castings. Woodworking and patternshops may use the tool for removing excess glue after it has dried and hardened. The tool is 9 inches long.



The tool has five strips of high speed steel for cutting

ADVERTISING PAGES REMOVED





Foundry Activities

Reflect Industrial Trends

STEEL CASTINGS CORP., Chicago, a new organization—(THE FOUNDRY for May, page 85), recently started the manufacture of electric furnace steel castings at its plant, Thirtieth street and Illinois Northern railroad. The foundry occupies a portion of the property of the Kedzie Foundry Co., but the two companies are not associated. Carbon, alloy and heat and corrosion resisting castings will be produced in sizes up to 1½ tons. A. F. Svenson is president of the new corporation. Other officers are: Vice president, H. J. Georgen; secretary-treasurer, J. E. Jehlen; foundry superintendent, L. Pawelk; metallurgist, F. G. Schaub. E. Veselik is associated in a sales capacity.

* * *

Pease Foundry Co. Ltd., Toronto, Ont., is increasing its facilities to meet enlarged business.

* * *

Vickers-Commonwealth Steel Products Ltd., New South Wales, recently has changed its name to the Commonwealth Steel Co. Ltd.

* * *

Deutsch Pattern Works, Milwaukee, has been incorporated to manufacture patterns, etc. by Simon and Anna Deutsch and Esther Traxler.

* * *

Oakland Foundry & Machine Co., Rochester, Mich., working night and day, has installed new molding machines and a large air compressor.

* * *

Toledo Foundry & Machine Co., 202 Cherry street, Toledo, O., has been dissolved, Herbert F. Jenne, being appointed receiver.

* * *

American Laundry Machinery Co., Buffalo road, Rochester, N. Y., is building a castings cleaning building. Werner, Spitz Construction Co. Inc., 11 Comfort street, Rochester, is contractor.

* * *

New Haven, Foundry Co. New Haven, Mich., has let contract to the Austin Co., Cleveland, for a foundry unit.

* * *

Leadmine Foundry, Ga'ena, Ill. is enjoying a continue1 run of good business in all lines, according to Frank Einsweiler, proprietor.

* * *

Sibley Machine & Foundry Corp., South Bend, Ind., is constructing an addition to its plant which will comprise 22,000 square feet of floor space to be used largely for cleaning grinding and shipping, with a portion devoted to molding.

* * *

Great Lakes Foundry Co., Port Huron, Mich., has filed notice of dissolution with the county clerk. The company, however, has not been in active service for five years.

* * *

Wizard Foundry Co., Wellsburgh, N. Y., recently has been organized by William H. Gilbert, 67 West Gray street, and Conway D. Thomas, 730 Riverside avenue, Elmira, N. Y.

* * *

Bohn Aluminum & Brass Corp., 2512 East Grand boulevard, Detroit, will build an addition to its plant No. 8, 2601 Clay street. L. W. Buckheit is in charge of plans.

* * *

Libert Machine Co., Green Bay, Wis., has been incorporated to conduct a general foundry and machine shop business by Milton A. and Erwin J. Libert and F. P. Cornelison.

* * *

An announcement of a contemplated expenditure for power equipment by the Florence Stove Co., Gardner, Mass., as presented in THE FOUNDRY, for May, page 91, was incorrect. THE FOUNDRY regrets that its news source was in error.

* * *

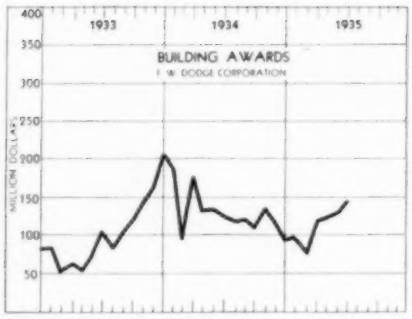
Index of foundry equipment orders for June, according to a report of the Foundry Equipment Manufacturer's association, Cleveland, was 100.1 as compared with 100.7 for May and 70.4 in June, 1934. Index of shipments was 82.2 for June as compared with 67.0 in May and 64.3 in June, 1934.

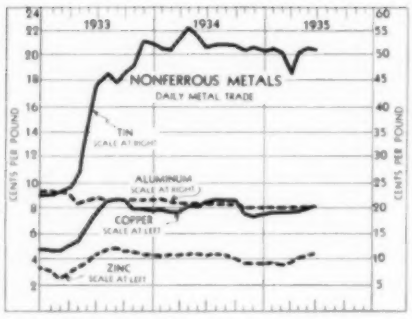
* * *

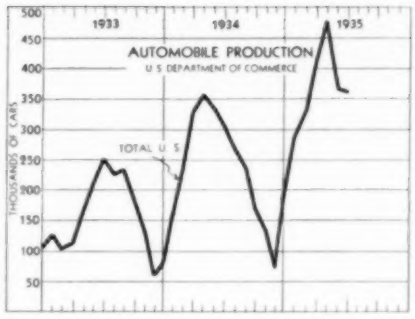
Central Pattern & Foundry Co., 3737 South Sacramento avenue, Chicago, reports that due to the con-

RAW MATERIAL PRICES
July 30, 1935

Iron	
No. 2 foundry, Valley	$18.50
No. 2 Southern, Birmingham	14.50
No. 2 foundry, Chicago	18.50
No. 2 foundry, Buffalo	18.50
Basic, Buffalo	17.50
Basic, Valley	18.00
Malleable, Chicago	18.50
Malleable, Buffalo	19.00
Charcoal iron, furnace	21.00
Coke	
Connellsville beehive premium	$5.00 to $ 5.10
Wise county beehive coke	4.30 to 5.00
Detroit by-product coke	8.50
Scrap	
Heavy melting steel, Valley	$11.50 to $12.00
Heavy melting steel, Pitts.(dlv.)	13.00 to 13.50
Heavy melting steel, Chicago	11.00 to 11.50
Stove plate, Buffalo	9.50 to 10.00
Stove plate, Chicago	7.00 to 7.50
No. 1 cast, New York	9.00 to 9.50
No. 1 cast, mchy., Chicago	9.50 to 10.00
No. 1 cast, Pittsburgh	13.50 to 14.00
No. 1 cast, Philadelphia	11.00 to 12.00
No. 1 cast, Birmingham	9.00 to 9.50
Car wheels, iron, Pittsburgh	13.00 to 13.50
Car wheels, iron, Chicago	12.00 to 12.50
Railroad malleable, Chicago	13.50 to 14.00
Malleable, Buffalo	13.00 to 13.50
Nonferrous Metals	**Cents per pound**
Castings copper, refinery	7.50
Straits tin	52.70
Aluminum, 99 per cent	19.00 to 21.00
Aluminum, No. 12 (Secondary)	16.50 to 17.00
Lead, New York	4.15
Antimony, New York	12.75
Nickel, electro	35.00
Zinc, East St. Louis, Ill.	4.40







tinued increase in the volume of business, it has been necessary for them to enlarge its plant. This enlargement will provide 55 additional molding floors; larger quarters for shipping, cleaning, and inspection departments.

* * *

Output of gray iron castings in the Philadelphia federal reserve district for June increased 0.3 per cent over May, according to reports of the Industrial Research department, University of Pennsylvania. Tonnage of malleable iron castings was nearly 10 per cent more in June than in May. Output of steel castings was 12 per cent more than in the preceding month.

* * *

Allegheny Steel Co., Brackenridge, Pa., has shipped two speed rings for two 66,000 horsepower turbogenerators in the Norris Dam power plant of the Tennessee Valley authority hydroelectric development project. The rings, aggregating 132,000 pounds weight, were cast in two sections in the company's plant. Similar rings for another U. S. government hydroelectric power project are now being produced.

* * *

Hill Clutch Machine & Foundry Co., 6400 Breakwater avenue, Cleveland, has purchased assets of the Canton Foundry & Machine Co., Canton, O., and will continue to operate it without change of name, as a division of the Cleveland company. Main offices of the division will remain in Canton for the present. Officers of the new division are: President, J. R. Bucher; vice president, A. C. McDaniel; secretary-treasurer, Milo Firestone.

* * *

Contracts placed recently for installation of the dust collector, developed by Claude B. Schneible, Chicago, have included foundries of the Kelsey-Hays Wheel Corp. and Dodge Bros. Corp., Detroit and the Chevrolet Motor Co., Saginaw, Mich. International Harvester Co. has installed five units at its Ft. Wayne and Chicago plants during the past 7 months.

* * *

Allis-Chalmers Mfg. Co., Milwaukee, is operating its tractor department in day and night shifts with production of about 2500 per month, usual summer slackness not being apparent.

New Trade Publications

PICKLING — International Nickel Co. Inc., 67 Wall street, New York, has prepared a booklet "Equipment Design for the Pickle House," in which it is pointed out that monel metal is especially suited to meet requirements of strength, corrosion, and easy fabrication.

CHAINS—Link-Belt Co., Indianapolis, recently has prepared a highly pictorial 32-page book which presents its silverstreak silent chain. Many types of applications on both long and short centers are shown.

CLAY—Eastern Clay Products Inc., Ellicott Square building, Buffalo, has published two folders, one on its Eifort fire clay for foundry use—the other on the use of its clay bond in the production and maintenance of foundry sand.

CIRCUIT BREAKERS — General Electric Co., Schenectady, N. Y., has issued a folder on a new moderate capacity oil blast circuit breaker, double and triple pole; 600 amperes—15,000 volts; 1200 amperes—7500 volts; 2000 amperes—5000 volts.

EXCAVATORS — Bucyrus-Erie Co., South Milwaukee, Wis., has issued a folder describing and illustrating the features of design of its 10-B type excavator.

PYROMETERS—A surface pyrometer, designed in two styles to permit temperature determinations on flat surfaces or on curved surfaces, is described in a folder recently published by the Pyrometer Instrument Co., 103 Lafayette street, New York.

NOZZLES—Advantages of Norbide pressure blast nozzles are described in a recent bulletin of the Norton Co., Worcester, Mass. Data also are given on nozzle sizes, adaptor numbers and dimensions of special types of nozzles, and instructions for the selection and use of the Norbide nozzle.

PORTABLE CRANE—Silent Hoist Winch & Crane Co., 762 Henry street, Brooklyn, N. Y., has prepared a well-illustrated booklet on its Krane Kar and Krane Krawler. Units consist of a boom mounted on a gasoline driven truck or crawler and providing utility for wide range of application.

FIRE EXTINGUISHING — Garrison Engineering Corp., Waterbury, Conn., has published a bulletin illustrating and describing its gun which uses a dry method of fire extinguishment. It is pointed out that the dry chemicals are shot in a cloud at the flame, shutting off the oxygen supply quickly.

REGULATING EQUIPMENT—Leeds & Northrup Co., 4900 Stenton avenue, Philadelphia, has published a bulletin on "Efficient Regulation of an Air-Conditioning System." The booklet is prepared to give valuable information on electrical thermometers to the owner, architect, engineer and contractor of an air conditioning installation.

COMPLAINTS—Metropolitan Life Insurance Co., New York, recently has issued a report dealing with "Methods of Handling Customer Complaints." The report deals with a special situation confronting one organization, but has been made available for general distribution to permit the contents to aid executives confronted with similar problems.

DUST ARRESTORS—Whiting Corp., Harvey, Ill., has published a bulletin on its tube-type dust filters. Features of operation such as simplicity, standardized units, effective dust removal, ease of maintenance, etc., are discussed. A cutaway illustration shows the construction of the unit and the arrangement of the tube filters.

Faked Foundry Facts

A Vibrator